VOL. XVIII, PART IV Published 30 April 1934

The British Mycological Society

(*Recognosce notum, ignotum inspice*)

TRANSACTIONS

Edited by

J. RAMSBOTTOM, B. F. BARNES and H. WORMALD

Price to non-members, Seven Shillings & Sixpence

LONDON
CAMBRIDGE UNIVERSITY PRESS
FETTER LANE, E.C. 4
CHICAGO: THE UNIVERSITY OF CHICAGO PRESS
(AGENTS FOR THE UNITED STATES)
BOMBAY, CALCUTTA, MADRAS: MACMILLAN
TOKYO: MARUZEN COMPANY LTD.
All rights reserved

PRINTED IN GREAT BRITAIN

LIST OF OFFICERS AND COUNCIL FOR 1933

Elected September 1932

President

Professor W. Brown, M.A., D.Sc.

Vice-Presidents

Miss G. Lister, F.L.S.

Dr B. Barnes

General Secretary

J. Ramsbottom, O.B.E., M.A., Sec.L.S.

British Museum (Nat. Hist.), Cromwell Road, London, S.W 7.

Secretary

Miss E. M. Wakefield, M.A., F.L.S.

The Herbarium, Royal Botanic Gardens, Kew, Surrey.

Treasurer

A. A. Pearson, F.L.S.

59, Southwark Street, London, S.E. 1.

Editors

J. Ramsbottom, Dr B. Barnes

and

Dr H. Wormald.

COUNCIL

The Officers, with the following in addition:

F. T. Brooks, Prof. A. H. R. Buller, Dr E. J. Butler, Miss C. A. Cooper, A. D. Cotton, Prof. O. V. Darbishire, F. G. Gould, Dame H. C. I. Gwynne-Vaughan, J. S. Hughes, A. E. Muskett, Dr G. H. Pethybridge, Prof. M. C. Potter, C. Rea, Prof. E. S. Salmon, Dr Alex. Smith, E. W. Swanton, W. H. Wilkins.

COMMITTEE FOR PLANT PATHOLOGY

A. Beaumont
Dr W. B. Brierley
Prof. W. Brown
Dr E. J. Butler
Dr W. J. Dowson
R. V. Harris
R. W. Marsh
W. C. Moore (*Secretary*)
A. E. Muskett
Dr G. H. Pethybridge (*Chairman*)
Dr R. G. Tomkins
W. M. Ware

The President and Secretaries of the Society *ex officio*

A FEW INTERESTING NORTH AMERICAN SMUTS

By R. CIFERRI

(With 1 Text-figure)

I. Revision of the smuts on *Bouteloua* spp.

In the course of a study of a Santo Domingo smut, found on *Bouteloua heterostega* (Trin.) Griff., it was necessary to secure specimens of smuts on other species of *Bouteloua*. The results of the re-examination of all the specimens at hand are here summarised.

1. On *B. heterostega* (Trin.) Griff., República Dominicana, Cordillera Septentrional, prov. Santiago, Santiago, Cuesta de Piedras, hill side, 17. xii. 1930 and 15. iii. 1931. Coll. *E. L. Ekman*, p.p. & *R. Ciferri*, p.p.

This smut, collected only twice in the same locality, is probably more common, but is easily overlooked on account of its inconspicuous characters. The habit is that of *Ustilago Hieronymi* Schröt. The spores are, as a rule, spherical, rarely ovoid, ellipsoid or irregular, dull brown, normally echinulate, but also varying to granular, dotted and rarely smooth. Well-developed echinules are conical, 1 μ or less in length. The diameter of two hundred spores, given in the ratio of 1–1 μ, is as follows:

Diameter μ:	14	15	16	*17*	18	19	20
Frequency N:	1	26	43	72	33	21	4=200

This smut was published as *U. Hieronymi* Schröt. var. *insularis* Cif. (3).

2. On *B. americana* Pilger, Guatemala, Chile, 9. xi. 1916. Coll. *W. Popenoe*, No. 2400. Mis. U.S. Dept. of Agric., Bur. of Pl. Ind., Path. and Myc. Coll. (under *U. Hieronymi* Schröt.).

Habit of *U. Hieronymi*. Spores spherical or spheroid, rarely ellipsoid, yellow-brown, smooth or dotted or more or less distinctly echinulate. Diameter of the spores:

Diameter μ:	9	10	11	*12*	13	14	15
Frequency N:	1	5	21	96	42	33	2=200

3. On *B. eriopoda* Torr. (?), U.S.A., Arizona, 1902. Coll. *Griffiths*. Mis. U.S. Dept. of Agric., Bur. of Pl. Ind., Myc. and Path. Coll. (under *U. Hieronymi* Schröt.).

As the preceding; spores as a rule more or less distinctly echinulate, but sometimes smooth. Diameter of spores:

Diameter μ:	8	9	10	*11*	12	13	14
Frequency N:	1	12	41	78	54	13	1=200

4. On the same host plant, U.S.A., Cochise, Arizona, x. 1900. Coll. *Griffiths*, ex Griff., West Amer. Fungi, No. 219. Mis. Miss. Bot. Gard. (under *U. minor* Nort.).

Similar to the preceding specimen, but spores yellow-brownish, epispore with a few, but quite long and distinct echinules, when observed under oil immersion. Diameter of spores:

Diameter μ:	6	7	8	9	*10*	11	12	13	14	
Frequency N:	4	6	11	38	72	45	16	7		1=200

Summarising the figures obtained from the two specimens:

Diameter μ:	6	7	8	9	10	*11*	12	13	14	
Frequency N:	4	6	12	50	113	123	70	20		2=400

5. On *B. aristidoides* (H.B.K.) Griseb., U.S.A., Cochise, Arizona, x. 1900. Coll. *Griffiths*, No. 218. Mis. U.S. Dept. of Agric., Bur. of Pl. Ind., Path. and Myc. Coll. (under *U. minor* Nort.).

Habit as the preceding specimens, but spores as a rule echinulate; frequently the echinules are very short and indistinct. Diameter of the spores:

Diameter μ:	10	11	12	*13*	14	15	16	17	
Frequency N:	2	13	41	77	55	9	2		1=200

6. On *B. bromoides* Lag., U.S.A., Pearce, Arizona, x. 1900. Coll. *Griffiths*, ex Griff., West Amer. Fungi, No. 227. Mis. Miss. Bot. Gard. (under *U. minor* Nort.).

Not distinct from the preceding, except in the spores being brownish, rarely yellowish, epispore well defined, clearly and densely echinulate; echinules acuminate, 1–1·5 μ in length. Diameter of spores:

Diameter μ:	7	8	9	10	*11*	12	13	
Frequency N:	2	9	26	62	70	28	3	=200

7. On *B. polystachya* (Benth.) Torr., U.S.A., Cochise, Arizona, x. 1900. Coll. *Griffiths*, ex Griff., West Amer. Fungi, No. 220. Mis. Miss. Bot. Gard. (under *U. minor* Nort.).

Habit of *U. Hieronymi*; spores light yellow-brownish, not densely but clearly echinulate. The epispore is lighter than in all specimens revised in the present paper. Diameter of spores:

Diameter μ:	6	7	8	9	*10*	11	12	13	
Frequency N:	3	7	15	36	77	51	9	2	=200

8. On *B. oligostachya* Torr. var. *major* Vasey, U.S.A., Cochise, Arizona, x. 1900. Coll. *Griffiths*, ex Griff., West Amer. Fungi, No. 217 (under *U. filifera* Nort.).

Spores yellow-brown, quite dull in colour, echinules not very abundant, but more or less distinct. Diameter of spores:

Diameter μ:	8	9	10	11	*12*	13	14	15	
Frequency N:	1	4	17	48	60	51	16	3	=200

9. On *B. oligostachya* Torr., U.S.A., Billings, Montana, viii. 1900. Coll. *Griffiths*, ex Griff., West Amer. Fungi, No. 217*a* (under *U. filifera* Nort.).

Spores yellow-brown to dull brown, smooth to dotted, never clearly echinulate or aculeate. Diameter of spores:

Diameter μ:	11	12	13	*14*	15	16	17	18	
Frequency N:	4	12	27	73	50	21	9	4	=200

10. On the same host plant, U.S.A., Stockton, Kansas, 15. viii. 1896. Coll. *Ellis*. Mis. U.S. Dept. of Agric., Bur. of Pl. Ind., Path. and Myc. Coll. (under *U. Boutelouae* Kell. & Sw.).

Sori destroying the ovaries; spores more or less regularly spherical, yellow, conspicuously echinulate. Diameter of spores:

Diameter μ:	7	8	*9*	10	11	12	
Frequency N:	4	11	96	51	31	7	=200

11. On the same host plant, U.S.A., Rooks County, Kansas, 15. viii. 1896. Coll. *Bartholomew*, ex Barth., Kansas Fungi. Mis. Miss. Bot. Gard. (under *U. Boutelouae* Kell. & Sw.).

Similar to the preceding specimen, but with spores light yellow, furnished with a few and short echinules. Diameter of spores:

Diameter μ:	5	6	7	8	*9*	10	11	12	
Frequency N:	3	7	12	39	83	42	12	2	=200

12. On *Bouteloua* sp., Mexico, Sonora, 27. viii. 1884. Coll. *Pringle*. Mis. Miss. Bot. Gard. (under *U. Hieronymi* Schröt.).

The habit is that of *U. Hieronymi*; spores yellow, clearly echinulate, but with echinules irregularly distributed. Diameter of spores:

Diameter μ:	10	11	12	*13*	14	15	16	
Frequency N:	2	15	43	79	40	20	1	=200

13. On *Bouteloua* sp., Mexico, Monelora, 1880. Coll. *Palmer*. Mis. Miss. Bot. Gard. (under *U. filifera* Nort.).

As the preceding, but with spores from brown-blackish to blackish, very densely echinulate, but the echinules are denser and shorter than in the former specimen. Diameter of spores:

Diameter μ:	11	12	13	*14*	15	16	
Frequency N:	1	21	68	78	29	3	=200

Summarising the results obtained, one may conclude that *U. Hieronymi* possesses spores variable from smooth or dotted to echinulate

or almost aculeate, these differences being evident not only in smuts on different host plants, but also in specimens on the same host plant.

The maximum and minimum variations of diameters, as well as the maximum frequencies according the host plants, are as follows (Fig. 1):

(1) On *B. americana*: from 9 to 15 μ; maximum frequency 12 μ.
(2) On *B. aristidoides*: from 10 to 17 μ; maximum frequency 13 μ.
(3) On *B. bromoides*: from 7 to 13 μ; maximum frequency 11 μ.
(4) On *B. eriopoda*: from 6 to 14 μ; maximum frequency 11 μ.
(5) On *B. heterostega*: from 14 to 20 μ; maximum frequency 17 μ.
(6) On *B. oligostachya*: from 11 to 18 μ; maximum frequency 14 μ.
(7) On *B. oligostachya* var. *major*: from 8 to 15 μ; maximum frequency 12 μ.
(8) On *B. polystachya*: from 6 to 13 μ; maximum frequency 11 μ.
(9) On *Bouteloua* sp.: from 10 to 16 μ; maximum frequency 13 μ.
(10) On *Bouteloua* sp.: from 11 to 16 μ; maximum frequency 14 μ.

The first species of smut described on *Bouteloua* was *U. filifera* Nort. (14); *U. minor* was published in the same paper. Clinton (5) referred the first species to the previously described *U. Hieronymi* Schröt. (15). Norton distinguished *U. minor* from *U. filifera* by the spores of 8–9 μ in diameter, and the less homogeneous protoplasm, though the latter characteristic is of very little taxonomic importance. Clinton (4) attributed to *U. minor* spores of 7–9 μ in diameter, minutely echinulate, from dull red-brown to light red-brown. Judging from the specimens studied, the smut on *B. eriopoda* labelled *U. minor* is indistinguishable from the smut on the same host plant labelled *U. Hieronymi*. The specimen on *B. aristidoides* shows larger spores, but similar to those of *U. Hieronymi*. The smuts on *B. bromoides* and *B. polystachya* are apparently identical with that on *B. eriopoda*. The total range of diameter on the specimens revised in this paper varies from 6 to 14 μ, with maximum frequencies of 10, 10, 11 and 13 μ.

In spite of the fact that the smut on the type host plant (*B. hirsuta*) was not examined, one may conclude that *U. minor* is distinguished from *U. Hieronymi* only with difficulty, at least within the morphological range. But, taking into consideration the possibility of host specialisation of the smut on *B. hirsuta*, in respect of the smut on *B. oligostachya* and *B. racemosa*, Norton's species may be reduced to a variety, with a slightly modified diagnosis on account of the maximum frequency of spore-diameter ranging from 10 to 11 μ. This conclusion agrees with the opinion of Clinton (4). The smut on *B. aristidoides* should be included in *U. Hieronymi*.

The Dominican smut possesses larger spores, not only as regards the maximum frequency, but also in the extreme range of the diameters. Taking into consideration also the geographic area (the

most southerly now known for the smuts on *Bouteloua*), and the possible host specialisation on *B. heterostega*, it is distinguished as a variety of *U. Hieronymi* (*U. Hieronymi* Schröt. var. *insularis* Cif.).

U. calcara Griff. (11), found on *B. breviseta*, was not studied. It may be distinguished from *U. Hieronymi* and the varieties of species of the same cycle, by causing witches' brooms on parasitised plants, by the pustulose sori, and by the smooth spores. Judging from the first and the third characteristics, the validity of the species may be assumed.

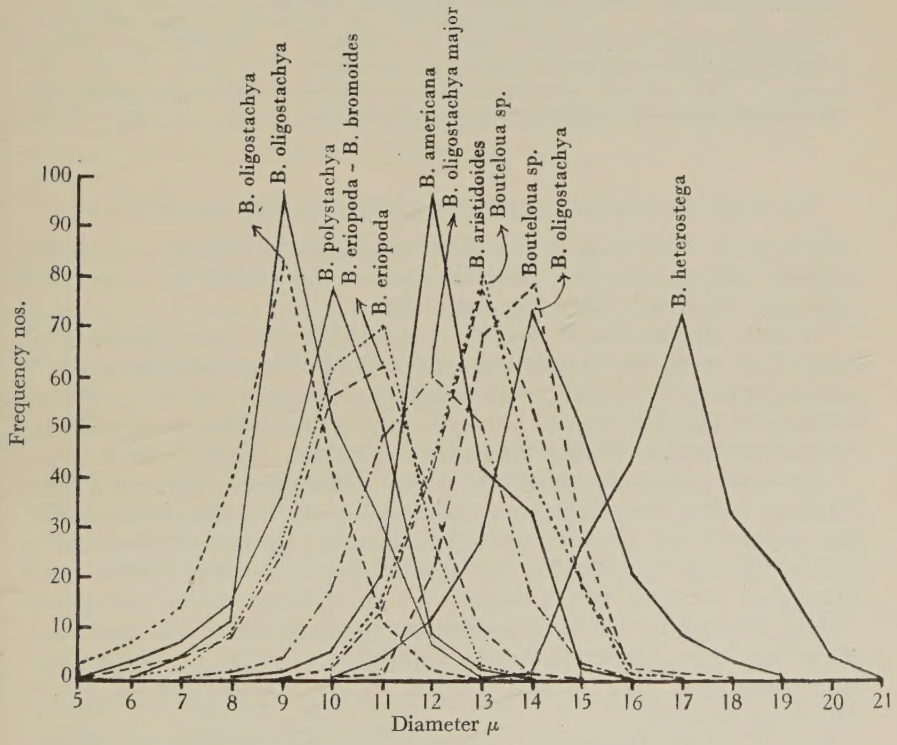


Fig. 1. Frequency of diameters of spores of *Bouteloua* smuts.

U. Boutelouae Kell. & Sw. (12) destroys the ovaries; this is the most outstanding differential characteristic from the species attacking the vegetative parts. Judging from the morphology of the spores, it appears to be indistinguishable from *U. minor*, with the exception of the spore colour being yellow, not yellow-brown, and the diameter falling between 5 and 12 μ, with a maximum frequency of 9 μ. This species appears to be different from *U. Boutelouae-humilis* Bref. (1), found on *B. humilis*, possessing larger and smooth spores (20–25 μ in diameter), and attacking the entire inflorescence.

The smuts on *Bouteloua* may be distinguished according to the characteristics listed in the following key:

Sori destroying the ovaries or the inflorescences.
  Sori destroying the inflorescences; spores of 20–25 μ diam. (type on *B. humilis*). *U. Boutelouae-humilis* Bref.
  Sori destroying the ovaries; spores of 5–12 μ diam. (type on *B. oligostachya*). *U. Boutelouae* Kell. & Sw.

Sori destroying the vegetative parts.
  Sori turgescent, erumpent, more or less inflated.
    Spores typically of 10–11 μ diam. (type on *B. hirsuta*). *U. Hieronymi* Schröt. var. *minor* (Nort.) Cif., nov.comb.
    Spores typically 12–14 μ diam. (type on *B. ciliata*). *U. Hieronymi* Schröt.
    Spores typically 17 μ diam. (type on *B. heterostega*). *U. Hieronymi* Schröt. var. *insularis* Cif.
  Sori linear, pustulose, applanate (type on *B. breviseta*). *U. calcara* Griff.

II. On the nomenclature of *Sphacelotheca pamparum*

Fischer de Waldheim (8) described a species of *Tilletia*, which he called *T. Magnusiana*, without indication of the locality or country of collection, with the following diagnosis:

"*Tilletia Magnusiana* F. de W. n.sp. M(asse) noire. Spores globeuses (de 10–14 micr.) ovoïdes, aplaties ou pointues, longues jusqu'à 16, larges jusqu'à 12 micr.; brunes-jaunes-claires; épispore à granulations très nombreuses et presque papilleuses. *Plantes nourricières. Panicum geniculatum* Willd. *Localisation des spores.* Dans l'ovaire."

Subsequently he repeated the same description, translated into Russian, but giving Lamarck as the authority for the name of the host plant (9). De Toni (7) included the description in Saccardo's *Sylloge*, giving the locality as doubtfully the West Indies, and Massee (13) included it (in English) in his monograph of the genus *Tilletia*, though he did not examine the type specimen. The inclusion of the species in the North American flora is accepted by Massee and by Seymour (16), but not by Clinton in the monograph of North American smuts (5).

In spite of not being able to obtain the type specimen of *Tilletia Magnusiana*, I do not question the identity of this species with *Sphacelotheca pamparum* Clint. (*Ustilago pamparum* Speg. (17)). The agreement of the descriptions is almost complete, and the West Indian host plant of *Sphacelotheca pamparum* is *Chaetochloa imberbis* (Poir.) Scribn. (*Setaria imberbis* (Poir.) R. & Sch.; *Panicum imberbe* Poir.), which is a synonym of the host plant given by Fischer de Waldheim, *Panicum geniculatum* Lam. (*Setaria geniculata* Beauv.; *Chaetochloa geniculata* Millsp. & Chase).

The synonymy is as follows:

Sphacelotheca Magnusiana (Fisch. de Waldh.) Cif., nov. comb. Syn.: *Tilletia Magnusiana* Fisch. de Waldh. (1877); *Ustilago Setariae* Speg.

(1880), not Niessl; *U. pamparum* Speg. (1884); *U. Kolaczekii* Kühn (1886); *Sphacelotheca pamparum* Clint. (1902).

The host plant range and the area of distribution is the following: on *Setaria* sp. (type) *S. glauca* Beauv., *S. geniculata* (Lam.) Beauv., *S. gracilis* H.B.K., (*S. imberbis* (Poir.) R. & Sch.); Argentine, Chile, Cuba, (Germany), Italy, Mexico, Uruguay, West Indies.

This smut was not found in Santo Domingo, where *Setaria geniculata* is parasitised by *Tolyposporium pampeanum* Speg., a species well distinct from *Sphacelotheca Magnusiana*, and apparently not previously quoted in the North American flora. In a paper on Santo Domingo smuts (2), I confused the names of the two fungi, calling the smut *Tolyposporium pamparum* instead of *T. pampeanum*, and so the synonymy listed there must be attributed to *Sphacelotheca Magnusiana*. *T. pampeanum* possesses glomerulate spores and a conidial form, but lacks the external pseudomembrane involving the sori.

III. The systematic position of *Tilletia Earlei* Griff.

This species was described by Griffiths (11) on culms of *Agropyron occidentale*, and since accepted by Clinton (4, 5). According to the description, it forms swollen sori from 10 to 100 mm. in length; the spores are light coloured, from 18 to 22 μ in diameter.

This smut, distributed by the describer of the species in the Exsiccata West. Amer. Fungi (No. 311), is clearly allied to *Ustilago macrospora* Desm. (6), of which it may be only a variety, distinct in the longer sori and the occasionally larger spores. Apparently, the Griffiths species was described from immature material.

This smut cannot be included in the genus *Tilletia*, which is limited to the ovaricolous (not culmicolous) smuts, and it should be transferred to the genus *Ustilago* (*U. Earlei* (Griff.) Cif., nov.comb.).

Acknowledgment

Thanks are here given to Mr John A. Stevenson, of the U.S. Department of Agriculture, and to the staff of the Missouri Botanical Garden, for securing specimens.

REFERENCES

(1) Brefeld, O. "Hemibasidii, Brandpilze." *Untersuch. a. d. Gesammtg. d. Mykol.* XII (1895), 116.
(2) Ciferri, R. "Smuts collected in the Dominican Republic by E. L. Ekman. I." *Ark. f. Botan.* XXIII (14) (1931), 17.
(3) —— "Mycoflora Domingensis Exsiccata. Cent. II (Nos. 101–200)." *Ann. Mycol.* XXXI (1933) 157.
(4) Clinton, G. P. "North American Ustilagineae." *Proc. Boston Soc. Nat. Hist.* XXXI (9) (1904), 357.
(5) —— "Ustilaginales." *North Amer. Fl.* VII (1) (1906), 13.
(6) Desmazières, J. B. H. J. *Pl. Crypt.* II (1850), No. 1727.

(7) De Toni, J. B. in Saccardo, P. A. *Syll. Fung.* vii (ii) (1888), No. 1777.
(8) Fischer de Waldheim, A. *Aperçu systém. Ustilag.* (1877), p. 47.
(9) —— *Les Ustilaginées*, ii (1878), 95.
(10) Griffiths, D. "Concerning some West American fungi." *Bull. Torrey Bot. Club*, xxix (1902), 290.
(11) —— "Concerning some West American smuts." *Bull. Torrey Bot. Club*, xxxi (1904), 85.
(12) Kellerman, W. A. and Swingle, W. T. "New Species of Kansas fungi." *Journ. Mycol.* v (1889), 13.
(13) Massee, G. E. "A revision of the genus *Tilletia*." *Bull. Misc. Inf. Roy. Gard. Kew*, Nos. 153–4 (1899), 146.
(14) Norton, J. B. S. "A study of the Kansas Ustilagineae, especially with regard to their germination." *Trans. Acad. Sci. St Louis*, vii (10) (1896), 237–8.
(15) Schröter, J. in Hennings, P. "Myxomycetes, Phycomycetes, Ustilagineae und Uredineae. Beitr. z. Pilzflora Südamerikas. I." *Hedwigia*, xxxv (1896), 213.
(16) Seymour, A. B. *Host Index of the Fungi of North America* (1929), p. 94.
(17) Spegazzini, C. "Fungi Guaranitici, Pugillus. I." *Anal. Soc. Cient. Argentina*, xvii (1884), 89.

NOTES ON BRITISH UREDINALES, INCLUDING ONE NEW TO THE BRITISH ISLES

By W. B. GROVE, M.A. and C. G. C. CHESTERS, M.Sc.

(With Plate XIX and 2 Text-figures)

Of these notes only the last one, on *Melampsorella Symphyti*, is written by the junior author (C. G. C. C.). The others, written by the senior author (W. B. G.), consist mainly of the results of observations due to many correspondents and communicated to him; but he wishes to put on record his great indebtedness to the junior author for the drawings and photographs by which they are illustrated.

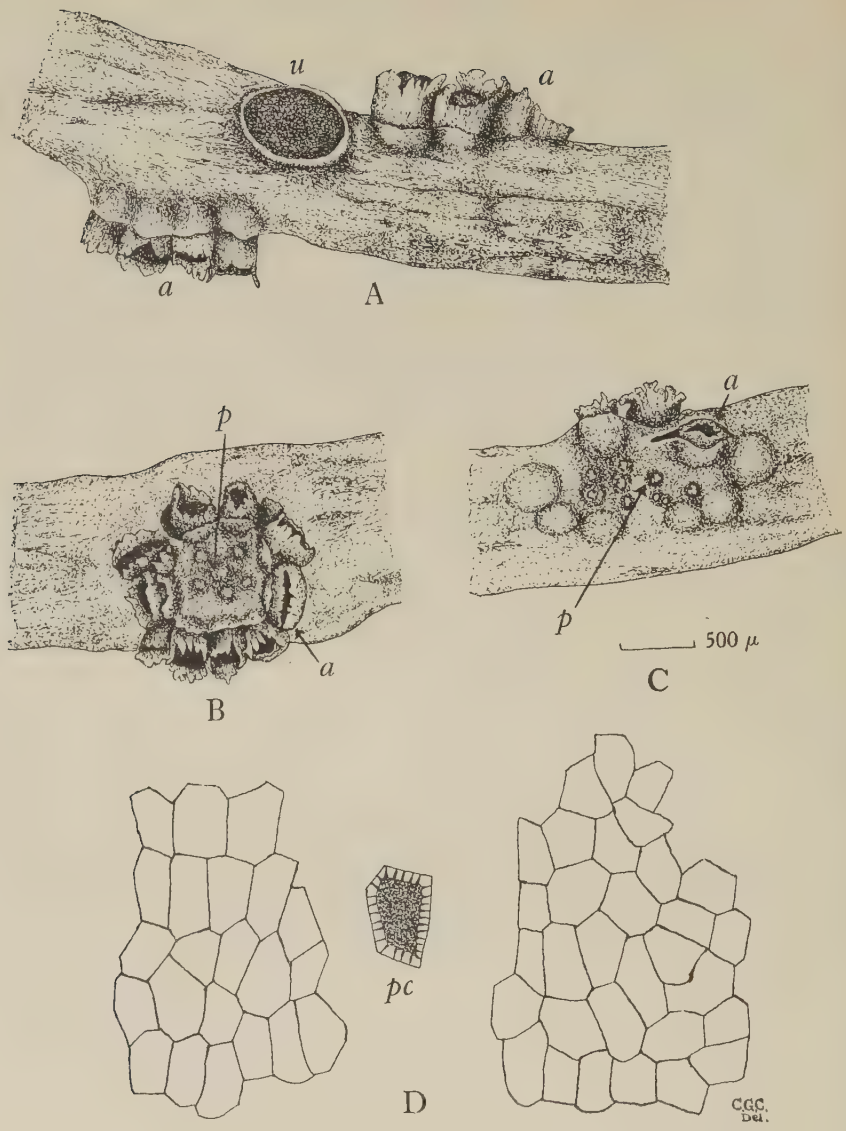
Uromyces sparsus Lév.

This rare Uredine, on *Spergularia*, of which I could say, in my *Rust-Fungi* (1913), p. 111, "I have seen no British specimen," has since been found at Porlock (Mr Norman G. Hadden), at the Farne Islands, and in other places, but only in the uredo- and teleutospore stages.

On June 12th of last year, I received from Mr F. T. Brooks, of Cambridge, a plant of *Spergularia marina*, collected by Mr V. J. Chapman at Scolt Head, Norfolk, on which was the remarkable aecidium described below (Pl. XIX, fig. 1); also on the same leaves were a few uredosori like those previously found on that host. On searching the literature in my library, I found a reference to an aecidium on *Spergularia* in Fragoso's "Uredales" (*Flora Iberica* (1925), p. 106). Here he describes pycnidia and aecidia growing on *Spergularia marginata*, found by Dr P. L. Unamuno in the salt-marshes of Unquera, but nowhere else in the Spanish peninsula.

On comparison of Mr Chapman's specimen with Fragoso's description, it was seen that the agreement was exact. The aecidia are remarkably brilliant in colour, almost scarlet, and could hardly be overlooked, if present, by anyone who was collecting Uredinales. The colour was, in fact, very similar to that of the very striking vermilion caeomata of *Xenodochus carbonarius*.

As will be seen by the appended description and figure (Text-fig. 1 D), the cells of which the peridium of the aecidial cups is composed are not arranged in lines or rows, but without any definite order whatever. This state of things is very unusual and was carefully described by Fragoso. The peridia have much the shape of an ordinary breakfast cup. The uredospores which accompanied the cluster-cups were exactly what they should be (Text-fig. 1 A, *u*). There were no teleutospores then present.



Text-fig. 1

A. Uredo- (*u*) and aecidial-sori (*a*) of *Uromyces sparsus* Lév. on a leaf of *Spergularia marina*. The irregular splitting of the peridium is indicated by the deeply indented margin. B. The aecidia are nearly always formed in a single ring round the area bearing the pycnidia (*p*). At *a* an aecidium on the point of opening shows the characteristic ragged slit in the peridial wall. C. A young aecidial sorus in which most of the aecidia have not yet broken through the epidermis. The pycnidia (*p*) are surmounted by drops of greyish nectar containing the pycnidiospores. D. Two portions of the peridial wall showing the very irregular arrangement of the cells which is responsible for the irregular splitting of the wall at maturity. *pc* represents a single peridial cell, illustrating the deep channels which penetrate its walls.

Description of Uromyces sparsus

Pycnidia amphigenous, dark red, in little clusters surrounded by the aecidia (Text-fig. 1 B and C).

Aecidia in a contiguous series, more or less forming a single circle, 1–2 mm. in diam., around the pycnidial group (Text-fig. 1 B), bright orange-red, almost scarlet when in perfection, nearly cylindrical or cup-shaped, with a much dentated but not recurved white margin; peridial cells firmly united to one another in a thin membrane, polygonal in outline, not arranged in distinct rows but irregularly (Text-fig. 1 D), with a wall about 3 μ thick, 4–5 μ on the outer side, in optical section deeply transversely striate; aecidiospores oval-quadrate, about 20 μ wide.

Uredosori on the leaves, scattered, small, oblong-oval, 0·5–1 mm. long, dark cinnamon, pulverulent. Uredospores roundish oval, with a wall (1–1·5 μ) equally thick all round, scarcely visibly echinulate or quite smooth, brownish yellow, with two to four more or less equatorial pores.

On *Spergularia marina* (=*S. media* Presl), Scolt Head, Norfolk (Mr V. J. Chapman), June, 1933.

In the Herbarium of the Royal Botanic Gardens, Kew, there is a specimen under the name *Uromyces sparsus* Lév., issued in Jaap's *Fungi Selecti* Exsiccati, No. 137*b*, of pycnidia and aecidia on "*Spergularia salina* Presl," gathered at Oldesloe in Schleswig-Holstein in June, 1906, by Chr. Sonder. This agrees with that from Scolt Head, except that it is on a smaller scale; the plants affected are very small (apparently seedlings), and of course the brilliant colours have badly faded. But the arrangement of the pycnidia and aecidia and the structure of the aecidium are exactly the same. Dr Sonder's record of the aecidium is repeated in the *Kryptogamen-flora der Mark Brandenburg* (Klebahn, Band v*a*, pp. 274–5) with figures of the aecidio-, uredo- and teleutospores on p. 280.

Uromyces Scirpi Burr.

This species has now been found in several places in south Britain, in Cornwall, Dorsetshire, Pembrokeshire, Anglesey, Norfolk, etc. It is heteroecious, and its aecidial stage has been known to be on *Glaux maritima* ever since Plowright, in 1890, infected the *Glaux* with germinating teleutospores from *Scirpus maritimus* brought from Paul on the banks of the Humber. At first he thought that it must be a distinct species, to which he gave the name of *U. maritimae* Plowr., but afterwards he satisfied himself that it was the same as *U. lineolatus* Desm., i.e. *Uromyces Scirpi* Burr.

For a long time it has been known that a similar *Uromyces* occurs in other countries on *Scirpus maritimus*, *S. fluviatilis*, and allied species, and that the infested plants were capable of infecting other plants

growing near, such as *Hippuris* and various Umbellifers, viz. *Sium*, *Pastinaca*, *Ferula*, *Daucus*, *Oenanthe aquatica*, etc., and producing aecidia on them.

Last year, 1933, Mr E. A. Ellis, of Gorleston, kindly sent me both the *Uromvces* on *Scirpus* and the *Glaux* from his district where the *Glaux* bears numerous aecidia. But, further, he has carefully examined *Oenanthe aquatica*, *Peucedanum sativum*, *Daucus Carota*, *Sium erectum* and *Hippuris vulgaris*, all growing in the vicinity of the *Scirpus*, some actually touching its leaves and surrounded by aecidium-bearing *Glaux*, yet on the whole of these plants not a single aecidium could be seen.

In October, 1931, Mr C. P. Hurst, of Landulph, near Saltash, Cornwall, found the teleutosori of *Uromyces Scirpi* on *Scirpus maritimus* in the estuary of the Tamar, and sent them to me. In May, 1932, he looked for aecidia on the *Glaux* which grows rather close to the *Scirpus*, but could find none. Then, on May 30th of last year, he came upon abundance of aecidia on plants of *Oenanthe crocata* (Pl. XIX, fig. 2) in the same locality (Kingsmill Lake, an inlet of the estuary), many actually touching the *Scirpus*. When he sent me some of the *Oenanthe* it could be seen that the clusters of aecidia on them were very similar in size and character to those on the *Glaux* from Norfolk. Again, on June 21st he found "Uredosori in profusion on the *Scirpus maritimus* where it was in close association or in actual contact with the infected *Oenanthe*, but not unless." At the same time he could find no aecidia on *Glaux* which was growing near by. Wherever the *Scirpus* was not in association with the *Oenanthe*, he says, it seemed quite free from the rust.

The *Uromyces* from Cornwall is morphologically indistinguishable, in its uredo- and teleutospore stages, from the Norfolk specimens and, as has been said, the aecidia are likewise very similar in colour and in arrangement so far as the difference in size of the two hosts permits, while the spores have the same measurements. There can hardly be any doubt that we have here a little biological sport of the *Uromyces*, infecting the *Oenanthe* capriciously instead of the *Glaux*; the cause of this freakishness, if any, may be beyond the limits of conjecture*. Plurivorous Uredinales are by no means unknown.

A similar case no doubt lies before us in the *Puccinia arenariicola* of Plowright, of which in 1884 Canon Du Port and he found the aecidia on *Centaurea nigra* on the sea-shore at Hemsby, Norfolk, as recorded in *Journ. Linn. Soc. Bot.* XXIV (1888), 90. It is obvious, on reading the descriptions of *Puccinia Schoeleriana* and *P. arenariicola*, that there is

* Since writing these words, I find that R. Maire, in 1909, discovered a similar aecidium on *Oenanthe crocata*, at the mouth of the Orne, Calvados (Normandy), in close association with the *Uromyces* on *Scirpus maritimus*. See Sydow's *Monographia Ured.* II, 306.

hardly a mentionable difference between the two species, except for the aecidial hosts. Mr Ellis, who is familiar with the locality, informs me that the aecidium on *Centaurea* has never been found there again. The explanation seems to lie in the supposition that the formation of the aecidium on that host was an accidental and capricious freak which has never been repeated. But the aecidium of *Puccinia Schoeleriana* on *Senecio Jacobaea* is common at Hemsby, and also *Carex arenaria* with its rust is abundant there. As Mr Ellis reminds us, *Centaurea nigra* is not a usual member of the *Carex arenaria* association; in fact, on June 18th last, he and his brother traversed the Norfolk dunes from Hemsby to Winterton, and in the course of a three hours' search neither of them "could find a single plant of *Centaurea nigra* in the whole system." "It looks," he says, "as if Plowright's aecidium was possibly a unique departure—the beginning of a new adventure on the part of *P. Schoeleriana*." Even Plowright's "duplicated" cultures, few in number, can hardly be said to prove the distinctness of these two species of *Puccinia* against the evidence now available.

Uromyces Acetosae Schröt.

This Uredine is rather common on *Rumex Acetosa* and *R. Acetosella* in its uredo- and teleutospore stages. But I remarked in 1913 (*Rust Fungi*, p. 116) that the aecidium stage "has not been found in Britain." At Whitsuntide last year (June 4th) I was walking over Boniface Down near Ventnor, when my daughter, who was with me, brought me a leaf of *R. Acetosa* on which to my astonishment I saw an aecidium I had never seen alive before (Pl. XIX, fig. 3). On the same leaf were plenty of uredosori and further search found others of both kinds.

On examination, after returning home, I found the spores of both kinds to be according to the descriptions of the spores of *Uromyces Acetosae*. The uredospores were finely and densely verruculose, not sparsely aculeate, so that, though no teleutospores were present, the fungus could not be mistaken for *Puccinia Acetosae* Körn. The aecidia could be distinguished at sight by their yellow colour from those of *Puccinia Trailii* Plowr. (which through the kindness of Mr Ellis had been seen a few days before, on the same host, from Norfolk); the aecidium of this latter fungus has a pure white peridium (Pl. XIX, fig. 4). Moreover, the clusters of aecidia and the sori of uredospores were in contact on the same purple spots, evidently on the same mycelium. This, to me, unique occurrence in the fungus of a stage which appears to be not uncommon on the Continent, will make it very interesting to know what other uredinologists have experienced this spring.

The foregoing three uncommon aecidia of *Uromyces* discovered in May and June of last year cannot be treated as isolated phenomena.

They must have some connection with the weather which prevailed at the time. It is easily understood that the germination of the basidiospores of most of the Pucciniaceae is a matter of great delicacy; for the success of the operation the warmth and humidity of the atmosphere must be exactly suitable. No doubt the extraordinary warmth of the spring, accompanied as it was by dewy nights and sunny days, was unusually favourable. When reproduction by basidiospores fails to be effected, most Uredineae can propagate themselves by their uredospores, but then the aecidium will be missing from the cycle. Germinable uredospores of *Puccinia glumarum* can be found in fresh-formed sori on leaves of grass during a mild spell in January or February, and the same thing may be true of other Uredines even if they have a known aecidial form. We can therefore readily perceive that an aecidial stage may for years habitually fail to be produced, and yet in a given year may make its unexpected and welcome appearance.

Uromyces striatus Schröt.

It is well known to British uredinologists that the fungus on *Trifolium minus* which I described and illustrated under the name *Uromyces striatus* in my *Rust Fungi* in 1913 is not that fungus, but *U. Jaapianus* Kleb. The true *U. striatus* occurs chiefly on *Medicago* and has the warts of the teleutospores arranged more distinctly in straight lines so as to cause apparent striations.

Since that time Mr C. P. Hurst has sent me abundant specimens of a *Uromyces*, mostly with uredospores only, on *Medicago maculata* from Saltash, Cornwall, which cannot well be anything but *Uromyces striatus*. Specimens on the same host belonging to this species have been found in the Scilly Islands, and Mr J. C. Arthur has been kind enough to send me a teleutosporic specimen on *Medicago hispida*, from Penzance, collected by him during his visit to England in 1930. The same species is recorded by Mr Hadden, on *Trifolium procumbens* from north Devon, in the *Journal of Botany* (1916), p. 53. But I must confess that I cannot find on any of our British specimens such distinct striations as are displayed by those imported from the Continent.

Puccinia Luzulae-maximae Diet.

(In *Annal. Mycol.* xviii, 57)

Uredosori on yellowish indeterminate spots, which are brownish or rubiginous in the centre, hypophyllous, scattered, minute, long, covered by the epidermis which at length splits, cinnamon-coloured. Uredospores ovoid, ellipsoid, or subglobose, brown, echinulate, 23–40 × 17–29 μ, with two germ pores.

Teleutosori hypophyllous, like the uredosori in size or rather larger, somewhat compact, naked or still surrounded by the ruptured epi-

dermis. Teleutospores oblong-clavate or linear, subtruncate or rounded at the apex, where the wall is 6–12 μ thick, attenuated or rounded below, gently constricted, brown, smooth, 30–60 × 12–23 μ; pedicels persistent, up to 35 μ long; a few mesospores are found intermixed.

On leaves of *Luzula maxima* (only), Cotton College, North Staffs., and Llanspyddid, Brecon (Rhodes, No. 3559).

This supposed species has been found in Germany, Austria, and Switzerland. The average greatest length of the teleutospores on *L. maxima* is given as between 43 and 46 μ, while that of the species on *L. campestris* is given as 38–40 μ. I do not believe that Dietel's fungus is anything but a form of *Puccinia oblongata* Winter, which has been recorded on *Luzula maxima* many times in England.

Puccinia Cirsii-lanceolati Schröt.

(In *Pilz. Schles.* (1889), p. 317; Sacc. *Syll.* VII, 606; Jacky, *Composit.-bewohn. Pucc.* p. 46)

Caeoma Kabatianum Bubák, in *Sitz.-ber. Böhm. Ges. Wissen.* (1899) = *Gymnoconia Cirsii-lanceolati* Bubák, *ibid.*

Jackya Cirsii-lanceolati Bubák, in *Oesterr. Bot. Zeitschr.* (1902), p. 42.

Since the short note published in the *Journal of Botany* (1931), p. 195, did not describe this fungus completely, a full description and figure are now given here.

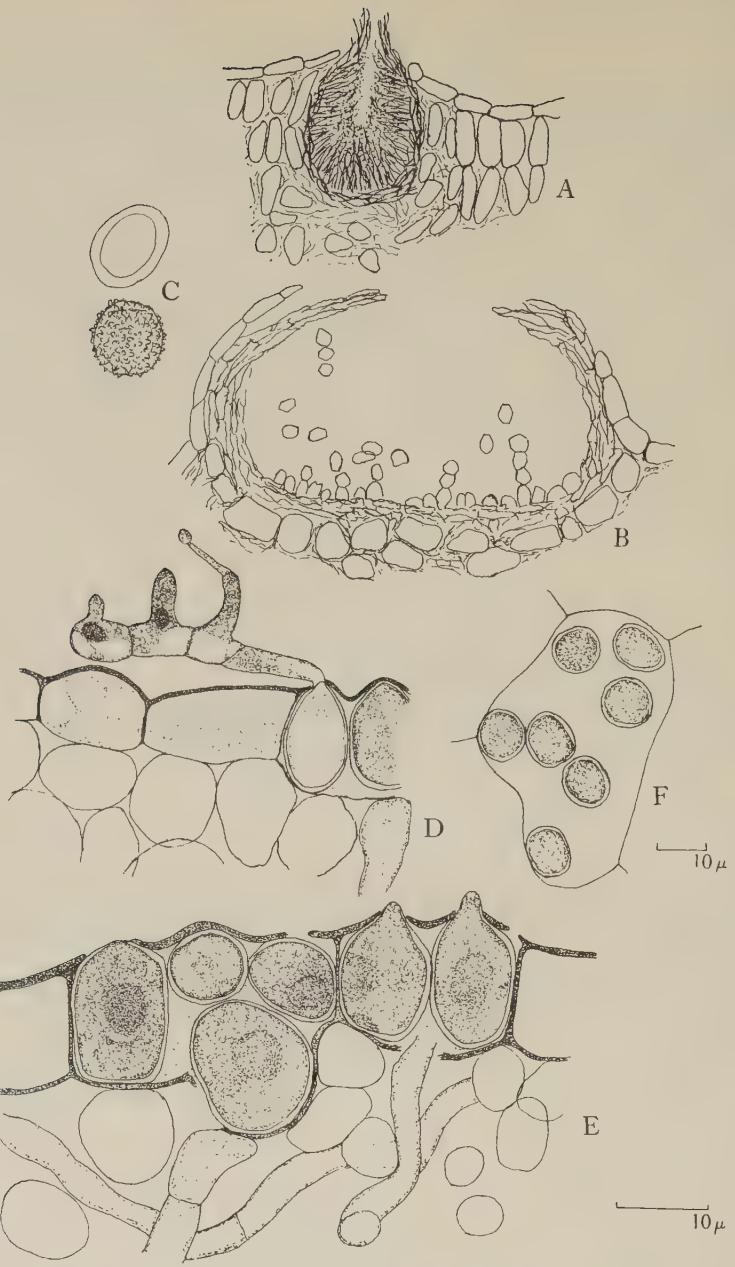
Pycnidia epiphyllous, flask-shaped, brownish, in little groups on the same spots as the aecidia (Text-fig. 2 A).

Aecidia hypophyllous, seated on small round yellow spots, scattered, often solitary, for a long time closed, then opening by a round median pore, at length broadly cup-shaped, whitish, with hardly a trace of any peridium (Text-fig. 2 B). Aecidiospores globose, subglobose, or ellipsoid, verruculose, pale orange, 22–35 × 20–28 μ, with a thick epispore (up to 2 μ), not remaining in long chains (Text-fig. 2 C).

Uredosori generally epiphyllous, scattered or often aggregated and confluent, surrounded by the cleft epidermis, pulverulent, ferruginous. Spores globose, subglobose, or ovoid, echinulate, brown, 24–26 × 20–28 μ.

Teleutosori generally epiphyllous, scattered or here and there aggregated, minute, surrounded by the cleft epidermis, pulverulent, dark brown. Spores ellipsoid, rounded but not thickened above, hardly or not at all constricted, rounded or gently attenuated below, punctate, obscure brown, 30–40 × 22–25 μ; pedicels short, hyaline.

On leaves of *Cirsium lanceolatum*. There is a possibility that it also occurs on *C. eriophorum*, for Jacky succeeded in transferring it from *C. lanceolatum* to *C. eriophorum*, but only in small quantity (*Centralbl.*



Text-fig. 2

Puccinia Cirsii-lanceolati Schröt. A. Longitudinal section through a pycnidium. B. Longitudinal section through an aecidium, showing that the wall is composed of ordinary mycelial hyphae. C. Aecidiospores, showing the very thick wall and its extremely warty exospore.

Melampsorella Symphyti Bubák. D. A basidium produced from a teleutospore within an epidermal cell of the host. E. Two infected epidermal cells containing teleutospores. Those on the right have just commenced to germinate. F. A tangential section of an epidermal cell, showing the several teleutospores it contains.

(D, E and F, microtome sections stained with haematoxylin.)

f. Bakt. u. Paras. II. IX (1902), 798). It is recorded from Mid and South-West Europe, and from North America.

I mentioned this species in my *Rust Fungi* (1913), but, as only the uredo- and teleutospores had up to that time been noticed on *Cirsium lanceolatum* in Britain, hesitated to include it in our flora. The reason why the aecidia had not been found is that they mostly occur, very fleetingly, only on the under side of the lower leaves of the Spear Thistle, often when these are in contact with the ground, and only in small numbers. But Dr Alex. Smith discovered them at Bourne, Cambridgeshire, in May, 1931, and also in Scotland. They were afterwards found in Norfolk, and in July, 1931, Dr P. G. M. Rhodes kindly took me to a locality in Worcestershire, near Evesham, where we found the aecidia, after some searching, in a damp tract of rough ground among trees and bushes. Dr Smith remarks that slugs are fond of eating out the infected spots, before the production of aecidia, possibly on account of the sweet liquid excreted by the pycnidia. If one considers how frequently the later stages are found on *Cirsium lanceolatum*, it may safely be surmised that the aecidia could be discovered in many other localities by looking for them with sufficient perseverance, at the right time, and in a suitable environment.

Melampsora euphorbiae-dulcis Otth

(In *Mitt. nat. Ges. Bern* (1868), p. 70)

[*Pycnidia* amphigenous, scattered among the caeomata, compressed globose, at first yellow, soon darker.

Caeomata amphigenous and on the stems, but more often hypophyllous, minute, orange. Caeomaspores more or less globose or ovoid, densely verrucose, pale golden, 22–28 × 20–24 μ; no paraphyses.] (Not yet found in this country.)

Uredosori mostly hypophyllous, scattered, connate and forming little round clusters, up to 500 μ diam., yellow. Spores more or less globose or ellipsoid, 15–23 × 12–20 μ; wall rather thick, echinulate, pale yellow; paraphyses numerous, capitate, 14–26 μ wide above, with rather thick walls.

Teleutosori amphigenous and on the stems, sub-epidermal, generally in dense groups, very small, clear-fuscous, finally darker. Spores ovoid or almost globose, but in tangential section becoming prismatic by mutual pressure, 18–40 × 7–15 μ, clear fuscous or somewhat darker, not thickened at the vertex.

On leaves and stems of *Euphorbia dulcis*.

This Uredine was collected at Glengariff in Ireland by the famous American mycologist, Mr J. C. Arthur, on August 29th, 1930, while he was on a visit to these islands for the International Botanical Conference, and he very kindly sent me a part of his collection.

Euphorbia dulcis is, presumably, an introduced species in Ireland. Its Rust is found in many parts of Europe, and not only on *E. dulcis*, but also on *E. Lathyris*, *E. pilosa*, *E. platyphyllos*, *E. stricta*, etc. This *Melampsora* is one of the many forms of the genus which sports so freely on *Euphorbia*, but it is very different from most of the others in its small and nearly globose teleutospores.

Melampsorella Symphyti Bubák

Formerly this fungus was known in Great Britain only in the uredospore stage and usually only on *Symphytum officinale* (Grove, *Rust Fungi*, p. 363). During the Spring Foray of the British Mycological Society to Ludlow in May, 1932, the teleutospores were discovered by Dr Alex. Smith.

On this occasion the teleutospores were found on the leaves of plants of *Symphytum peregrinum* (*S. asperrimum*) which were growing at the edge of a wood in Boyne Park, about ten miles from Ludlow. Trees of *Abies pectinata*, the alternate host of this *Melampsorella*, were growing in the vicinity. Very few of the plants of *Symphytum* bore teleutospores and only the older leaves were infected with this stage. Repeated visits to the locality have failed, so far, to discover any aecidia on the *Abies*.

The teleutospores are hypophyllous and arise on the same mycelium that bears uredospores but at a later stage of growth. Usually they occupy the areas of the leaf surface between the uredosori and form pinkish or puce-coloured crusts which contrast strongly with the rather pale green of the leaf and also with the pale yellow uredosori.

Several teleutospores occur in each epidermal cell (Text-fig. 2 F). They are hyaline or slightly yellowish when mature, spherical or ovoid, and measure about 10–18 × 8–12 μ. The wall is rather thin and shows no well-defined pore except at the time of germination (Text-fig. 2 E). Apparently germination occurs without any lengthy resting period and I have frequently observed basidia in nature during late May and the early part of June of 1932 and 1933. At other times incubation of from 12 to 24 hours in a moist chamber is sufficient for their production. On germination the apical end of the spore elongates and the basidium bursts through the end of the papillate projection which has pierced the outer epidermal wall. Frequently all the teleutospores in one epidermal cell germinate at once (Text-fig. 2 E) and the epidermal wall is destroyed to such an extent that the teleutospores may be displaced and lie free on the leaf surface. The basidia are rather thick and short and give rise to four spherical or pear-shaped basidiospores 4–4·5 × 3·5–4 μ in size which are formed on long tapering sterigmata (Text-fig. 2 D). In moist weather out of doors the teleutospore crusts are covered by

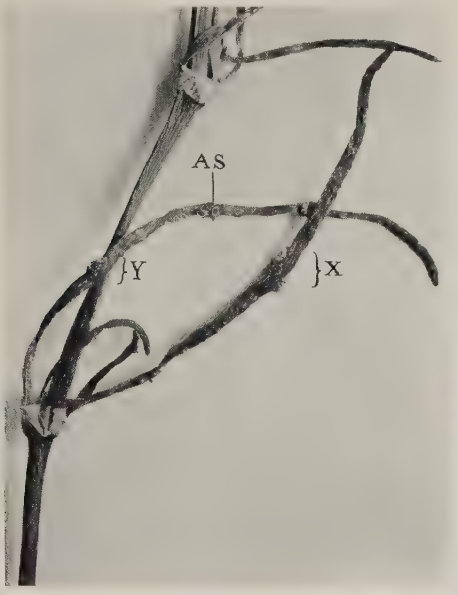


Fig. 1

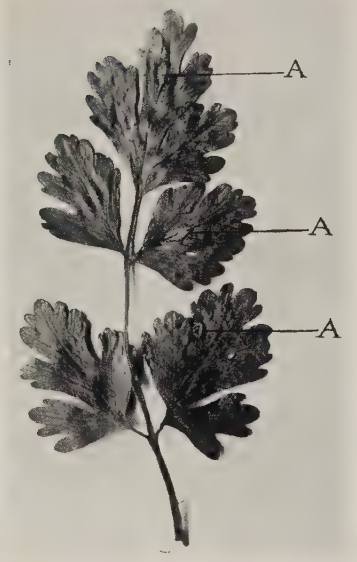


Fig. 2

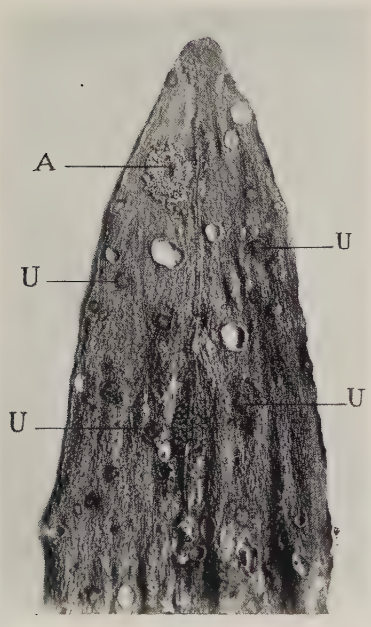


Fig. 3

Fig. 4

masses of intertwined basidia and in this condition they become almost white in colour.

Melampsorella Symphyti is frequently found in the Midland Counties on *Symphytum officinale*, but only the uredospores are, so far, known upon that host. Probably the occurrence of the teleutospores at Boyne Park is due to the favourable site and further search may yet discover the aecidial stage in that area.

EXPLANATION OF PLATE XIX

Fig. 1. *Uromyces sparsus* Lév. A portion of a plant of *Spergularia marina* infected with the fungus, showing aecidial sori (*AS*). The region marked *X* has been enlarged in Text-fig. 1 A and bears a uredosorus and two aecidial sori. At *Y* (see also Text-fig. 1 C) a young aecidial sorus occurs; the white spots represent nectar extruded from the mouths of the pycnidia.

Fig. 2. *Uromyces Scirpi* Burr. Leaflets of *Oenanthe crocata* bearing aecidial sori (*A*) of this fungus.

Fig. 3. *Uromyces Acetosae* Schröt. The apical portion of a leaf of *Rumex Acetosa* bearing aecidial sori (*A*) and uredosori (*U*) of this fungus. The brilliant red areas on which the sori are situated are not shown distinctly in the photograph and the same remark applies to Fig. 4.

Fig. 4. *Puccinia Trailii* Plowr. For comparison with Fig. 3; a portion of a leaf of *Rumex Acetosa* bearing sori whose aecidia are almost pure white in colour in contrast to the rich yellow of those of *Uromyces Acetosae*.

(Figs. 1, 3 and 4 are photographed at the same magnification, Fig. 2 is slightly reduced.)

A COMPARATIVE STUDY OF THE FUNGI ASSOCIATED WITH BLIGHT DISEASES OF CERTAIN CULTIVATED LEGUMINOUS PLANTS

By A. SATTAR, B.Sc., Ph.D., F.L.S.

(With 5 Text-figures)

I. Introductory

My attention was first directed to the study of diseases of pulse crops caused by *Ascochyta* and related fungi in connection with the blight disease of gram (*Cicer arietinum* L.), an important Indian agricultural crop. Field observations were undertaken in 1927 and were later extended to include similar diseases of *Pisum sativum* L. (pea) and *Ervum lens* L. (lentil) as grown in the Punjab. In the last two years a detailed comparison has been made of the cultural characters and pathogenicity of the organisms causing these diseases. In addition a number of similar forms, either isolated from European material by me or obtained in culture from various sources, have been studied.

II. Historical

In view of the confused nature of the literature dealing with the blight diseases of the crops under consideration, it is proposed to arrange the various statements under the heading of each particular host plant.

(*a*) *Pisum sativum* L.

A fungus causing blight of *Pisum sativum* L. was first described as *Ascochyta Pisi* by Libert (17). According to Comes (8), however: "this disease, studied especially on Chick-pea (*Cicer arietinum* L.), was known even to Theophrastus and Pliny, and was noted by Re under the name of rabbia of Chick-pea." Further descriptions were given by Link (20) and Berkeley (2, 3). Saccardo's description (27) agrees with Libert's and is accepted as the typical description of the species.

Stone (33) claimed that *Ascochyta Pisi* Lib. has a perfect stage in *Mycosphaerella pinodes* (Berk. & Blox.) Stone. This conclusion was supported by the work of Vaughan (36) and Melhus (22). Jones (13), however, pointed out that the disease caused by *Mycosphaerella pinodes* differed markedly from that due to *Ascochyta Pisi*, and that these two organisms had been confused in the literature. Linford and Sprague (19) confirmed Jones's results and gave descriptions to separate *Ascochyta Pisi* Lib. from *Mycosphaerella pinodes* (Berk. & Blox.) Stone. The pycnidial stage of the latter fungus, which is the actively

parasitic stage, was named *Ascochyta pinodes* by Jones (14). Still a third fungus causing a foot-rot and leaf-spot of *Pisum sativum* was reported by Jones and Linford (12) from U.S.A. They referred to it briefly as a "*Phoma*-like fungus." Jones (14) named this form *Ascochyta pinodella*.

Depazea pisicola recorded by Berkeley (3) on fruits of pea in Britain and given in the *Sylloge Fungorum* as *Ascochyta pisicola* (Berk.) Sacc. is considered by Saccardo (27) to be synonymous with *Ascochyta Pisi* Lib., a conclusion accepted by Linford and Sprague (19).

(*b*) *Vicia*

A fungus causing blight of *Vicia sepium* was first described by Libert (18) as *Ascochyta Viciae*. Cooke (10) attempted to place Libert's specimen under his *Phyllosticta Viciae*, but as the only difference lay in the septation of the spores, Sprague (31) considers that Cooke had immature material of *Ascochyta Viciae*.

Ascochyta vicicola Trail (34), on pods and leaves of *Vicia sepium* in Scotland, is considered by Saccardo to be doubtfully different from *Ascochyta Viciae*. Stone (33) merges both with *Ascochyta Pisi* Lib. under the name of the perfect stage *Mycosphaerella pinodes* (Berk. & Blox.) Stone. Scalia (30) likewise considers *Ascochyta Pisi* to include both the preceding species.

Sprague (31) showed that the species of *Ascochyta* occurring in America on *Vicia sativa* and other vetches differed in spore measurements from *Ascochyta Pisi* Lib. but resembled it closely in cultural characters. He found that under artificial conditions each could infect the other's host plant and therefore he considered both to be forms of *Ascochyta Pisi* Lib.

On the other hand Ludwig (21), who carried out inoculation experiments on species of *Phaseolus* and *Vicia* with *Ascochyta Pisi* isolated from pea, reported uniformly negative results except on pea. Ratschlag (26) found that the forms of *Ascochyta* on pea and broad bean were able to attack the other's host but that the vigour of attack, as measured by percentage of infected plants or by number and size of lesions, was always greatest when each fungus was tested on its own host. This type of result was also obtained by Sprague.

(*c*) *Cicer arietinum* L.

The causal organism of gram blight (known in Italy as "rabbia") was named *Zythia Rabiei* by Passerini (23), thus indicating that the spores were unicellular and hyaline. This diagnosis was either overlooked or was not accepted by later workers. Thus Comes (9) identified the fungus on *Cicer arietinum* as *Ascochyta Pisi* Lib. Saccardo (27), together with various text-book authors and observers such as Peglion (24), Allescher (1) and Scalia (28), have followed Comes's identification.

Prillieux and Delacroix(25) named a fungus with unicellular spores on *Cicer arietinum* as *Phyllosticta cicerina*. Scalia(29) mentioned this fungus as occurring in association with blight disease of *Cicer arietinum* and considered it as an immature stage of *Ascochyta Pisi* Lib.

Trotter(35), after a study of the gram fungus on plants in nature and of Comes's and Saccardo's herbarium material, concluded that his fungus was identical with theirs and that it was not *Ascochyta Pisi* Lib. but a *Phyllosticta*. It appeared to resemble *Phyllosticta cicerina*, but he named it *Phyllosticta Rabiei* (Pass.) Trotter. He stated that, due to Passerini's imperfect observations of the pycnidial tissue, the fungus was wrongly placed in the group Nectrioideae of the Sphaeropsidales. He mentioned that it was not rare to find a few hyalodidymous spores, but he considered that this did not necessarily place the fungus in *Ascochyta*. His observations were made on mature material. He thought it possible that if *Ascochyta Pisi* were cultivated for a long time on *Cicer arietinum* it might take on the form of a *Phyllosticta* and that a sharp demarcation between the two genera might not exist.

Ciferri(6), reporting the seriousness of this disease in Spain, remarked that since *Phyllosticta Rabiei* (Pass.) Trotter differed from *Ascochyta Pisi* Lib. mainly in having only unicellular spores, both these organisms might be the same, and that the septation of the spores might vary according to the host.

Sprague(32) has recently shown that *Phyllosticta Rabiei* (Pass.) Trotter is distinct from *Ascochyta Pisi* Lib., but that the former fungus is not so definitely a *Phyllosticta* as Trotter considered it to be, inasmuch as it may show 2–5 per cent. of bicellular spores both on the host plant and in culture*.

Labrousse(15) described the fungus as *Phyllosticta Rabiei* (Pass.) Trotter, stating that no bicellular spores occurred on the host though a few were observed in artificial culture. In a second note(16) he changed his views and described the fungus as *Ascochyta Rabiei* (Pass.) Labrousse because the fungus produced 2–4 per cent. of bicellular spores on artificially inoculated plants.

The fungus causing blight† of gram in India was first described by Butler(5) as *Mycosphaerella pinodes* (Berk. & Blox.) Stone (*Ascochyta Pisi* Lib.), that is, he considered it to be identical with the pea blight fungus on the evidence brought forward by Comes and Stone. He does not appear to have studied the fungus in detail. He noted that the perfect stage had not been observed in India. He states that the

* Sprague overlooked the fact that Trotter recorded a small percentage of bicellular spores.

† The Indian cultivator applies three names to this disease: (1) "Soka," which means scorch; (2) "Tawi" (=a circular hot plate), the reference being to the circular spread of the disease in the field; (3) "Hawa" (=wind), which suggests its rapid spread.

earliest record of the disease in India was in 1911, from the North-West Frontier Province, though there is little doubt that it had existed there for centuries past.

(*d*) *Ervum lens*

In a recent paper Bondartzeva-Monteverde and Vassilievsky (4) recorded an *Ascochyta* on lentil in Russia. Their account is a preliminary one, and indicates that a taxonomic study of this and similar fungi is in progress. This appears to be the only reference to an *Ascochyta* on lentil.

III. Experimental

A. *Material and methods*

The fungi included in this study are listed below. For convenience in description the various species or strains will be referred to by the names or symbols given within square brackets.

(1) *Ascochyta Pisi* Lib.—isolated by me from stem lesions on *Pisum sativum* at Rawalpindi, Punjab, India, in 1930, and found to be identical in cultural behaviour with a stock culture of *Ascochyta Pisi* Lib. obtained from the Centraalbureau voor Schimmelcultures, Baarn, Holland. [*A. Pisi* (Ind.).]

(2) A fungus found in association with (1), but differing from it on the host in spore characters; isolated from leaf lesions. [P.]

(3) *Ascochyta Pisi* Lib.—isolated by me in the autumn of 1930 from lesions on pods of *Pisum sativum* bought in London, and from stem-spots at Windsor. These proved to be identical. [*A. Pisi* (Eng.).]

(4) An *Ascochyta* isolated from pod lesions of wild vetch (*Vicia sativa*) at Slough in 1931. [V.]

(5) An *Ascochyta* isolated from pod lesions of *Ervum lens* at Palampur, Punjab, India, in 1930. [L.]

(6) A fungus isolated from stem and pod lesions of *Cicer arietinum* at Rawalpindi and Campbellpur, Punjab, India, in 1930. [G.]

(7) *Phyllosticta Rabiei* (Pass.) Trotter—isolated from stem lesions of *Cicer arietinum* from Madrid, Spain, in 1929. [*P. Rabiei.*]

(8) *Mycosphaerella pinodes* (Berk. & Blox.) Stone—a culture from the Centraalbureau voor Schimmelcultures, Baarn, Holland. [*M. pinodes.*]

(9) *Ascochyta pinodella* Jones—a culture from the Centraalbureau voor Schimmelcultures, Baarn, Holland. [*A. pinodella.*]

At the beginning of the work the purity of all these cultures was guaranteed by monosporal culturing.

Stock cultures were kept on oatmeal agar. In subculturing, and in the general preparation of tubes and plates for detailed study, the inoculum was taken from the spore exudate except in P. and *A. pinodella*, the pycnidia of which either do not give spore exudates or do

so only slightly. These two fungi were subcultured by transferring pieces of the agar medium containing both mycelium and spores.

The following media were employed, the quantities given being the amounts in 1 litre of the solution:

(1) Oatmeal agar—oatmeal 50 gm., agar 20 gm.

(2) Gram-meal agar—crushed gram seeds 50 gm., agar 20 gm.

(3) Pea-meal agar—crushed pea seeds 50 gm., agar 20 gm.

(4) Brown's agar A—asparagin 2 gm., glucose 2 gm., K_3PO_4 1·25 gm., $MgSO_4$ 0·75 gm., agar 15 gm.

(5) Medium (4) with the asparagin replaced by KNO_3 2 gm.

(6) Brown's agar B—asparagin 0·2 gm., glucose 2 gm., K_3PO_4 1·25 gm., $MgSO_4$ 0·75 gm., potato starch 10 gm., agar 15 gm.

Inoculation experiments were conducted during the colder months of the year in glasshouses at the Chelsea Physic Garden, London, and during the summer with potted plants in the open at the same place, and with plants growing in the field at the Biological Station, Slough.

Further details of the methods employed will be given at appropriate places in the text.

B. *Description of disease symptoms and general morphological characters of the parasites on their natural hosts*

(*a*) *Symptoms.* These are set out briefly in Table I. The data refer to naturally infected plants, except for *M. pinodes*, P., and *A. pinodella*, and the observations were made at the time of the first isolations. In the three fungi mentioned the symptoms were observed on plants artificially infected under indoor and outdoor conditions in England.

The nature of the injury and the intensity of attack produced by the various fungi on their own host plants are as follows:

(1) *A. Pisi* (India): young plants may totally dry up; mature plants normally show only spots, but under favourable conditions these may enlarge and cause death of parts above the spots. The seed produced is frequently infected.

(2) P.: no appreciable injury produced on above-ground parts, but slight foot-rot may occur.

(3) *A. Pisi* (England): similar to (1).

(4) V.: similar to (1).

(5) L.: similar to (1).

(6) G.: under moist conditions, at or near the flowering or fruiting stages, the whole plant is destroyed. When leaf infections are numerous, the effect is a scorch. Girdling of the stem frequently occurs with killing of all the parts above. Sometimes a whole plant wilts and dies without showing any lesions in the aerial parts: the stem below ground or even the root is then found to be girdled. Pod and seed infections are frequent.

(7) *P. Rabiei:* artificial infections have behaved similarly to (6);

Table I. *Symptoms produced by various fungi on their natural host plants*

Fungus	Parts attacked	Symptoms	Macroscopic appearance of pycnidia
1. *A. Pisi* (India)	Foliage, stem, pods	Definite sunken tan to brown spots, circular on leaves and pods, elongated on stems and petioles often surrounded by a prominent dark margin; affected pods often with a pitted appearance	Pycnidia showing as tan brown dots, generally grouped near centre of lesion, on mature plant parts generally scattered
2. P.	Old leaves, old tendrils and roots	Diffused spots on dying leaves only; parasitism very weak; slight foot-rot may occur	Pycnidia black, scattered
3. *A. Pisi* (Eng.)	As in (1)	As in (1)	As in (1)
4. V.	Do.	As in (1) but lesions always with reddish margins	Do.
5. L.	Do.	As in (4)	Do.
6. G.	Do.	Spots tan brown to dark, generally the latter, when old with brown margin and yellowish centre; shape as in (1); spots often girdling stem	Pycnidia tan brown when young, dark when old; zonally arranged on parts exposed to light, diffusely on lower parts of plant
7. *P. Rabiei*	Do.	Do.	Pycnidia rather dark, otherwise as in (6)
8. *M. pinodes*	Foliage, stem, pods and roots	Lesions on leaves brown to purplish, irregular, without definite margins, in wet conditions enlarging, becoming more circular and somewhat zonate; on stems brown or black to purplish streaks which are more pronounced at nodes; on pods brown to purplish specks which may enlarge and coalesce; affected pods often appearing pitted; severe foot-rot often shown	Pycnidia minute black and scattered
9. *A. pinodella*	Do.	Do.	Do.

in particular pod and seed infection were observed, in contrast to Labrousse's (15) statement that seed infection by this fungus does not seem to take place in French Morocco.

(8) *M. pinodes:* similar to (1) but in addition severe foot-rot is caused; seed infection not examined by me but reported by Jones and other workers.

(9) *A. pinodella:* almost equally severe as (8) in causing foot-rot but less actively parasitic on aerial parts; pod infection frequent, seed infection also occurs.

To summarise the above data:

(1) The Indian and English strains of *A. Pisi* show identical host reactions and both are distinct from *M. pinodes* and *A. pinodella*. The fungus P. which occurs in association with *A. Pisi* in India is virtually a saprophyte.

(2) The Indian fungus from gram (G.) appears to be similar to *P. Rabiei*.

(*b*) *Size of pycnidia.* Data based on the measurement of fifty pycnidia of each fungus on its own host plant under the conditions specified on p. 280 are given in Table II.

Table II. *Size of pycnidia of the various fungi on their natural host plants*

Fungus	Limits of variation (μ)	Average (μ)
1. *A. Pisi* (Ind.)	60–235× 55–215	159×133
2. P.	—	—
3. *A. Pisi* (Eng.)	75–225× 75–205	141×124
4. V.	65–235× 60–200	146×126
5. L.	80–220× 65–190	138×118
6. G. I	85–295× 85–245	182×159
II	65–235× 65–225	172×154
III	125–245×105–235	183×161
7. *P. Rabiei*	80–240× 60–215	156×142
8. *M. pinodes*	75–175× 60–160	134×128
9. *A. pinodella*	70–184× 65–170	126×121

These figures show that the range of average size of the pycnidium within the group is not very striking, though the pycnidia of *M. pinodes* and *A. pinodella* are smaller than those of the others, especially towards the upper limit.

(*c*) *Size of pycnospores.* Table III gives the results of one hundred measurements.

Numerous observations made from time to time on pycnospores taken from artificially infected plants showed that the limits of spore size agreed well with those given in Table III. The fungi fall into four groups, viz.

(1) Spores approximately $15\times3{\cdot}7\,\mu$ (ratio l./w.$=4{\cdot}1$). L. and V.

(2) Spores approximately $13\times3{\cdot}5\,\mu$ (ratio l./w.$=3{\cdot}8$). *A. Pisi* (Ind.), *A. Pisi* (Eng.) and *M. pinodes*.

(3) Spores approximately $10\times4\,\mu$ (ratio l./w.$=2{\cdot}5$). G. and *P. Rabiei*.

(4) Spores approximately $5{\cdot}5\times2{\cdot}5\,\mu$ (ratio l./w.$=2{\cdot}2$). P. and *A. pinodella*.

While these figures may be used as a general guide for each of the fungi, it should be noted that spore size varies with the environmental

Table III. *Size of pycnospores of the various fungi on their natural host plants*

Fungus	Nature of material	Limits of variation (μ)	Average (μ)	Length ÷ Width
1. *A. Pisi* (Ind.)	Pods, collected in normal weather	8·0–18·0 × 2·5–5·5	12·7 × 3·5	3·6
2. P.	Do.	3·0–7·0 × 1·0–3·5	4·7 × 2·3	2·0
3. *A. Pisi* (Eng.)	Pods, collected in somewhat moister conditions than in (1)	10·0–18·0 × 2·5–5·5	12·9 × 3·3	3·9
4. V.	Do.	10·0–20·0 × 3·0–6·0	15·4 × 3·6	4·3
5. L.	Pods, collected in normal weather	10·0–20·0 × 3·0–6·0	13·1 × 3·8	4·0
6. G. I	Stem, Do.	6·0–15·0 × 3·0–6·5	9·7 × 3·9	2·5
II	Pods, Do.	6·0–15·0 × 3·0–7·0	10·3 × 4·2	2·5
7. *P. Rabiei*	Exsiccatum obtained from Madrid, Spain	6·0–16·0 × 3·0–6·5	10·4 × 3·9	2·7
8. *M. pinodes*	Leaves and stems from plants artificially infected at 20° C. under fairly moist conditions	8·0–18·0 × 2·5–5·5	13·6 × 3·8	3·6
9. *A. pinodella*	Do.	4·5–13·0 × 1·5–4·0	6·7 × 2·8	2·4

conditions at the time the spore sample is taken. I have noticed particularly that spores collected in wet weather tend to be larger than at other times. The variation in this respect is most marked in the fungi G. and *P. Rabiei*, as the figures below show:

(1) Pycnospores of *P. Rabiei* (from Table III). Av. = 10·4 × 3·9 μ.

(2) Pycnospores of G. (from Table III). Av. = 10·0 × 4·0 μ.

(3) Pycnospores of *P. Rabiei* collected under very moist conditions at fruiting time of the plant. Av. = 12·8 × 5·1 μ.

(4) Pycnospores of G. collected as in (3). Av. = 13·1 × 5·3 μ.

The fact that the spores of *P. Rabiei* under certain conditions may approximate in size to those of *A. Pisi* and *M. pinodes* (*A. pinodes*) partly explains the confusion regarding the systematic position of these fungi.

(*d*) *Septation of pycnospores.* Spore septation, based upon counts of 1000 spores, is given in Table IV.

These fungi thus fall into three classes as regards degree of septation:

(1) With most of the spores 1-septate, viz. *A. Pisi* (Indian and English strains), V., L. and *M. pinodes*.

(2) With 1-septate spores present in fair numbers but with a predominance of non-septate spores, viz. *A. pinodella*.

(3) With 1-septate spores practically absent, viz. P., G. and *P. Rabiei*.

Table IV. *Degree of septation of pycnospores of the various fungi on their natural host plants*

Fungus	Percentage of pycnospores			
	Non-septate	1-septate	2-septate	3-septate
1. *A. Pisi* (Ind.)	1	99	Rare	0
2. P.	100	0	0	0
3. *A. Pisi* (Eng.)	1	99	Rare	0
4. V.	1	98	1	Rare
5. L.	Rare	99	1	Rare
6. G.	99	1	Rare	0
7. *P. Rabiei*	99·5	0·5	Rare	0
8. *M. pinodes*	5	95	Rare	0
9. *A. pinodella*	80	20	0	0

Observations made under a variety of weather conditions and at different stages of the life history of the host plant indicate that the degree of spore septation is very constant for all the members of the first group, and for the fungus P. There is, however, a fair amount of variation for the three fungi, *A. pinodella*, G. and *P. Rabiei*. With the first of these, the percentage of 1-septate spores has been found to vary from 5 per cent. to 50 per cent., the remainder being non-septate. The factors responsible for this variation have not been determined. In G. and *P. Rabiei* (which behave similarly) more extensive observations have been made, which are collected in Table V.

Table V. *Degree of septation of pycnospores of* P. Rabiei *and G. under different conditions*

Fungus	Weather conditions	Host material	No. of spores counted	Percentage septation	
				Non-septate	1-septate
G.*	Dry	2 months old	1000	99·5	0·5
	Fairly moist	2½ ,,	1000	99·0	1·0
	Dry	5 ,, (fruiting)	1500	99·5	0·5
	Fairly moist	5 months old	1000	98·0	2·0
	Very moist	5 ,,	1000	88·0	12·0
P. Rabiei	Dry	1 month old	500	99·6	0·4
	Fairly moist	1 ,,	500	99·2	0·8
	Dry	3 months old (flowering)	1000	99·4	0·6
	Very moist	3 months old	1000	95·0	5·0

* Observations recorded by the writer in India.

(*e*) *Shape of pycnospores.* The ratio length/width of the spores of the various fungi is given in the last column of Table III. This ratio is greatest in species with the longer spores, which tend to be rod-like, and smaller in species with short spores, so that the latter are more ovoid.

C. *Study of the fungi on artificial media*

(*a*) *Macroscopic features*

(1) *Linear growth rate.* This was determined in the usual way by measuring the daily increase in diameter of colonies in Petri dish cultures. The factors which materially influence growth rate were found to be temperature, nature of the nutrient medium and

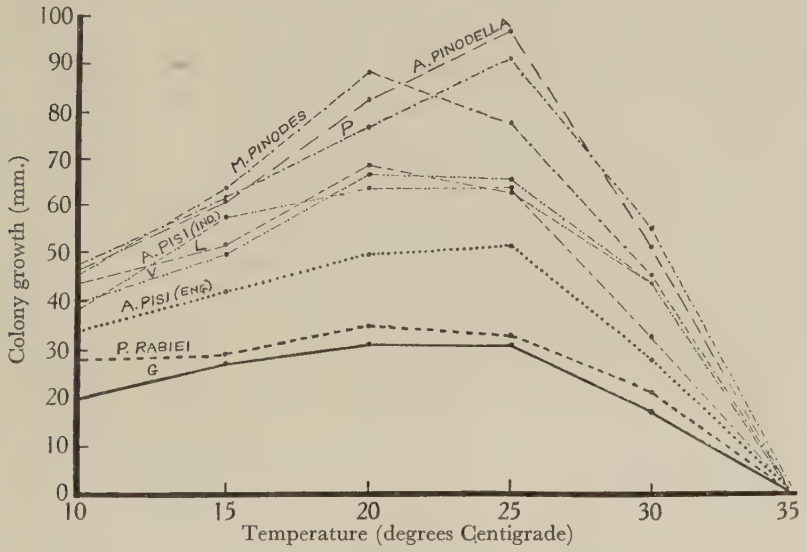


Fig. 1. Showing effect of temperature upon colony diameter, after fourteen days' growth on oatmeal agar.

hydrogen-ion concentration. Such factors as depth of nutrient medium and illumination as against darkness were tested in some detail and found to be unimportant.

The effect of *temperature* upon growth rate is illustrated in Fig. 1 for growth upon oatmeal agar. The following general observations may be made:

(i) The two fungi from *Cicer arietinum*, G. and *P. Rabiei*, have the least growth rate over the whole range.

(ii) The most rapidly growing fungi are *M. pinodes*, *A. pinodella* and P.

(iii) The fungi *A. Pisi* (Ind.), *A. Pisi* (Eng.), V. and L. are intermediate.

(iv) The upper limit of growth lies between 30° and 35° C., and is near 33° as subsidiary determinations showed.

(v) All the fungi have their optimum at about 20–25° C. In *A. pinodella* and P. growth is distinctly better at 25° than at 20° C., while with all the rest growth is about equal at both these temperatures or is somewhat better at the lower temperature.

The English strain of *A. Pisi* does not grow so fast as the Indian strain. This difference is more pronounced on some media than on others, but holds under a large variety of conditions.

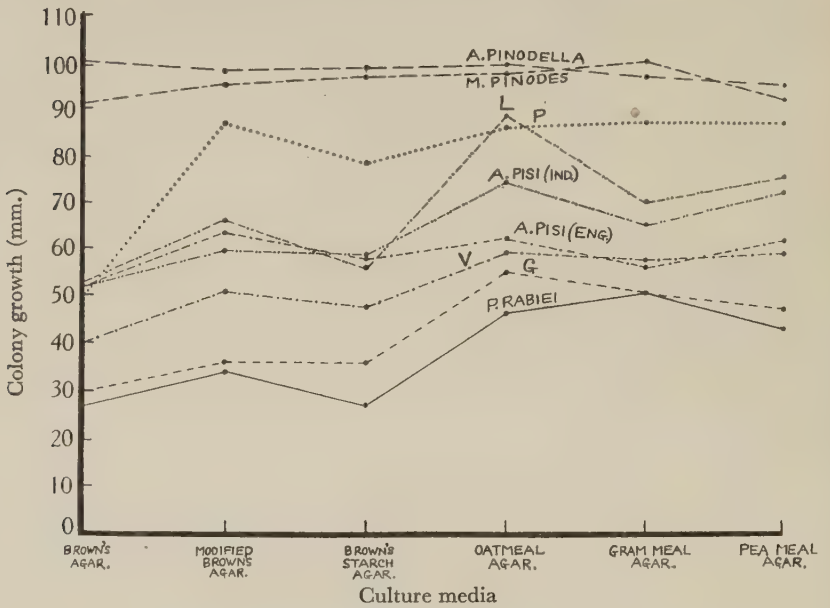


Fig. 2. Showing colony growth on different culture media at laboratory temperature (18–23° C.) after twenty-one days' growth.

The effect of the *cultural medium* upon growth rate is illustrated in Fig. 2, in which the diameters of the colonies produced on six different media after twenty-one days' growth are shown graphically. These measurements were made on a triplicate series of plates run simultaneously at laboratory temperature, so that the external conditions were the same for all. It is clear that the actual growth rates vary considerably from one medium to another, but again one notes the general tendency for these fungi to fall into the three groups to which allusion has already been made (p. 285).

The effect of *hydrogen-ion concentration* upon growth rate is illustrated in Fig. 3. The various acid-alkali reactions were obtained by the

addition of hydrochloric acid or sodium hydroxide, and the resulting *p*H's were determined colorimetrically by Clark's (7) method.

The figure shows clearly that all the fungi, while having the maximum growth at about the neutral point, grow fairly well over a range of *p*H from 4·0 to 8·8. On the acid side the growth falls rapidly between *p*H 4·0 and 3·0, and stops between *p*H 3·0 and 2·4. On the alkaline side all of them give strong growth at *p*H 8·8, but the point at which growth stops was not determined.

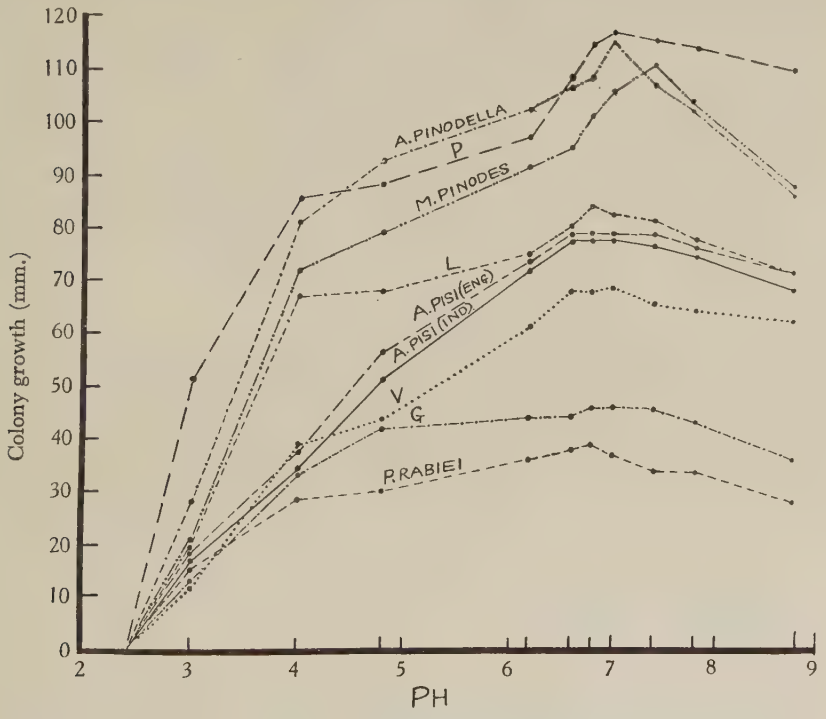


Fig. 3. Showing effect of *p*H on colony growth (twenty-one days' growth at 20° C. on Brown's starch agar).

The experiments on growth rate show that, at least over a *p*H range from about 5 to 8·8, these fungi fall into the same three groups already mentioned (pp. 285 and 286).

(2) *Aerial mycelium.* The relative abundance of aerial mycelium of the various fungi grown on different media at laboratory temperature (18-23° C.) is shown in Table VI.

The following points are clear from the table:

(i) The production of aerial mycelium by all the fungi is much less on synthetic than on the natural media.

(ii) *M. pinodes*, P., V., L. and *A. pinodella* produce more aerial mycelium than *A. Pisi* (Ind.), *A. Pisi* (Eng.), G. and *P. Rabiei*.

(3) *Sporulation.* All the fungi when grown at laboratory temperature (18–23° C.) produce pycnidia with spores nearly mature within four to seven days on all the media used.

Table VI. *Amount of aerial mycelium of the various fungi on different media*

Fungus	Brown's agar	Modified Brown's agar	Brown's starch agar	Oatmeal agar	Gram-meal agar	Pea-meal agar
1. *A. Pisi* (Ind.)	–	–	–	+	+	+
2. P.	+++	+	+	++++	++++	++++
3. *A. Pisi* (Eng.)	–	–	–	+	++	++
4. V.	+	–	+	+++	+++	+++
5. L.	+	–	+	+++	+++	+++
6. G.	+	–	–	+	++	++
7. *P. Rabiei*	–	–	+	+	++	++
8. *M. pinodes*	++	++	++	+++	+++	+++
9. *A. pinodella*	++	++	++	+++	+++	+++

– means almost nil.

Linford and Sprague (19) state that in *A. Pisi* "Pycnidia are not produced immediately except in contact with the walls of the culture vessel, but in tubes after ten days or more, as the agar shrinks away from the glass, a thin mycelial growth covers the new surface and pycnidia usually form in abundance." On the contrary I have always observed that this fungus produces pycnidia within four to seven days and that these are first formed at the place where the medium is inoculated. This difference is perhaps to be ascribed to a difference in methods of culture, for while Linford and Sprague subcultured the fungus by transferring pieces of agar containing perhaps both mycelium and spores, I always used spores for this purpose. I have observed that when the inoculum used in subculturing this fungus is young mycelium, the formation of pycnidia is delayed considerably (by about ten to fourteen days), and becomes very feeble even in the first generation. Whether this is due to an intrinsic difference between mycelium and spores or whether it indicates a type of saltation was not determined.

The pycnidia are abundant and closely packed together over the whole plate in *A. Pisi* (Ind.), *A. Pisi* (Eng.), G. and *P. Rabiei*. In *M. pinodes*, P. and *A. pinodella*, while pycnidia are formed freely, they are more scattered, especially towards the margins of the cultures. The forms V. and L., and especially the former, show feebler sporulation. It is worthy of note that *A. Pisi*, V. and L., which have behaved rather similarly in the characters hitherto described, show a distinct difference in this respect.

A. Pisi, G. and *P. Rabiei* also produce many imperfect pycnidia or acervulus-like structures on the natural media used.

(4) *Spore exudate.* The pycnidia of all the fungi except *A. pinodella* and P. exude spore masses in abundance on all the culture media used.

(5) *Colony colour.* The colour of the colonies of these fungi is the general resultant of the colours of pycnidia, spore exudate and aerial mycelium, and is thus affected by variations in the amounts of these. While the colours in themselves do not vary much from one medium to another, they are best marked on oatmeal agar. Table VII gives the details of the colours shown on this medium.

Table VII. *Colour of pycnidia, spore exudate, and aerial mycelium of the various fungi on oatmeal agar at laboratory temperature* (15–23° C.)

Fungus	*Colour of pycnidia	*Colour of spore exudate	*Colour of aerial mycelium
1. *A. Pisi* (Ind.)	Tan becoming brown	Vinaceous pink to flesh colour	White
2. P.	Tan-black	No spore exudate	At first white, with age becoming grey to dark grey
3. *A. Pisi* (Eng.)	Tan-brown	Vinaceous pink	White
4. V.	Tan-grey	Do.	At first white, with age becoming grey
5. L.	Tan	Do.	Mouse-grey
6. G.	Tan-black	Tawny olive	At first white, with age grey
7. *P. Rabiei*	Black	Buff to tawny olive	Grey to dark grey
8. *M. pinodes*	Do.	Vinaceous pink	At first white, with age grey to dark grey
9. *A. pinodella*	Do.	No spore exudate	Do.

* Colours as in Ridgway.

The table shows that whereas both forms of *A. Pisi* finally have brown pycnidia and white mycelium, the forms V. and L. have grey pycnidia and grey mycelium. The remaining forms *M. pinodes*, *A. pinodella*, P., G. and *P. Rabiei* differ from *A. Pisi* in having the pycnidia black when mature and the old mycelium dark grey.

(6) *Zonation.* The two forms *P. Rabiei* and G. very often produce pycnidia in characteristic concentric zones when the culture plates are kept on the laboratory bench (temp. 18–23° C.) and exposed to the alternation of day and night. The factors responsible for the production of these zones have not been investigated.

(*b*) *Microscopic features*

(1) *Size of pycnidia.* The size of pycnidia (50 measurements) of the nine fungi on Brown's starch agar (20° C., 21 days) is given in Table VIII.

Table VIII. *Size of pycnidia on Brown's starch agar*

Fungus	Limits of variation (μ)	Average (μ)
1. *A. Pisi* (Ind.)	163–328 × 149–312	232 × 213
2. P.	140–245 × 70–227	119 × 143
3. *A. Pisi* (Eng.)	175–343 × 147–332	245 × 224
4. V.*	114–295 × 108–280	192 × 162
5. L.	122–315 × 112–262	196 × 156
6. G.	122–234 × 122–210	175 × 147
7. *P. Rabiei*	98–175 × 87–150	129 × 119
8. *M. pinodes*	115–238 × 98–210	175 × 150
9. *A. pinodella*	96–217 × 96–175	144 × 129

* Based on measurements of 20 pycnidia.

It is clear that the pycnidia of *P. Rabiei* and *A. pinodella* are decidedly smaller than those of the other fungi. A comparison of this table with Table II shows, however, that pycnidial size is very variable in all these fungi and is therefore of little importance in determining their taxonomic position.

(2) *Size of pycnospores*. The size of pycnospores taken from cultures on the six media used (20° C., 21 days) was found to vary only slightly and to agree closely with that shown on the natural host plants.

(3) *Septation of pycnospores*. This was studied under the same conditions as above and on the same six media. Representative figures for two media are given in Table IX.

Table IX. *Septation of pycnospores* (*percentage*)

	Brown's agar			Gram-meal agar		
Fungus	Non-septate	1-septate	2-septate	Non-septate	1-septate	2-septate
1. *A. Pisi* (Ind.)	10	90	R	R	100	R
2. P.	100	0	0	100	0	0
3. *A. Pisi* (Eng.)	10	90	R	R	100	R
4. V.	R	99	1	R	98	2
5. L.	1	99	R	R	100	R
6. G.	100	R	0	99	1	0
7. *P. Rabiei*	100	R	0	99	1	0
8. *M. pinodes*	5	95	R	6	94	R
9. *A. pinodella*	100	0	0	100	0	0

R = rare.

The variation in degree of septation of the pycnospores from one medium to another is usually slight. A comparison of Tables IV and IX, however, shows that while *A. pinodella* has on an average 20 per cent. of 1-septate spores on its natural host, it produces only non-septate spores on artificial media.

It thus appears that *P. Rabiei* and G., which may produce on the host (Table V) 5 and 12 per cent. of 1-septate spores respectively,

do not produce more than 2 per cent. of such spores on any of the artificial media. The remaining fungi have remained fairly constant

Fig. 4. Camera lucida drawings of spores taken from oatmeal cultures at 20° C. after twenty-one days. (×550.)

(1) *A. Pisi* from England; (2) Fungus from lentil (L.); (3) *A. Pisi* from India; (4) Fungus from *Vicia sativa* (V.); (5) Fungus from gram (G.); (6) Fungus from pea in India (P.); (7) *P. Rabiei*; (8) *A. pinodella*; (9) *M. pinodes*.

in this character, with the exception of both forms of *A. Pisi*, which on Brown's agar and oatmeal agar produce 5–10 per cent. of unicellular spores.

These fungi fall into two groups, based on the septation of their pycnospores:

(i) Most of the spores 1-septate; *A. Pisi* (Ind.), *A. Pisi* (Eng.), L., V. and *M. pinodes*.

(ii) 1-septate spores practically absent; *P. Rabiei*, G., P. and *A. pinodella*.

Typical spores of the various fungi from oatmeal agar (20° C., 21 days) are shown in Fig. 4 (1–9).

(4) *Chlamydospores*. On all the media tested *M. pinodes* and *A. pinodella* have produced chlamydospores similar to those described by Linford and Sprague (19) and others. The fungus P. also produces similar chlamydospores but none of the other fungi has been observed to develop these structures.

D. *Germination of spores*

All these fungi germinate readily in distilled water except *P. Rabiei* and G. *M. pinodes* and *A. pinodella* in particular germinate very rapidly. From this feature alone it can be deduced with certainty that the data given by Stone ((33), p. 566) refer to *M. pinodes* and not, as he considered, to *A. Pisi*.

The germination of *P. Rabiei* and G. in distilled water is poor and irregular. Certain factors which influence the germination of these fungi, and which appear to be of significance in connection with their parasitism, will be dealt with in Part II.

The maximum temperature for germination lies between 30 and 35° C., being near the latter point for *M. pinodes*, P. and *A. pinodella*, and about 2° lower for the remainder. The optimum temperature lies between 15 and 20° for the fungus L.; near 20° for *A. Pisi* (both strains) and V.; between 20 and 25° for *M. pinodes*; near 25° for P.; and between 20 and 30° for *A. pinodella*. The minimum lies below 10° for all.

The *number of germ-tubes* to each spore varies in the different fungi and to a certain extent in each fungus according to the time of observation. Thus the percentage of spores with more than one germ-tube increases with time and is greater at any time for spores germinating at the optimum temperature, for the reason that such spores are more advanced in their growth. Two main groups can however be separated on this basis:

(1) Most of the spores producing two or three germ-tubes: *M. pinodes*, V., L., *A. Pisi* (Ind.) and *A. Pisi* (Eng.).

(2) Almost all the spores germinating with one tube: *A. pinodella*.

The fungus P. behaves irregularly, sometimes producing only one germ-tube to each spore, at others showing up to 60 per cent. of spores with two germ-tubes. This fungus is somewhat peculiar in that it tends to form chains of secondary spores at rather high temperatures.

Representative sets of spores in process of germination are illustrated in Fig. 5 (1–8).

The *degree of spore septation* at the time of germination, which is a

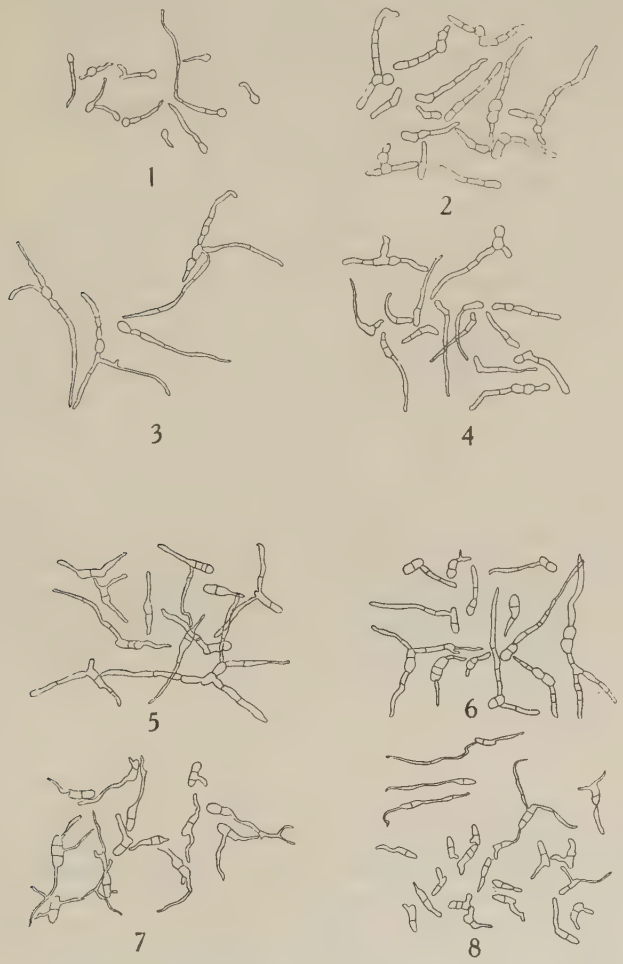


Fig. 5. Camera lucida drawings of germinating spores. (×375.)

(1) *A. pinodella*; (2) *P. Rabiei*; (3) Fungus from pea in India (P.); (4) Fungus from gram (G.); (5) Fungus from *Vicia sativa* (V.); (6) *M. pinodes*; (7) Fungus from lentil (L.); (8) *A. Pisi* from India.

matter of taxonomic importance, has been studied in some detail. Germination tests have been carried out at a variety of temperatures (10–30° C.). From these it has appeared that the behaviour of each fungus is very similar at each temperature used. It will be sufficient

to present the data at the optimum temperature (20°), germination being in water except where otherwise stated.

Table X. *Degree of septation of pycnospores at germination*

Fungus	Percentage Non-septate	Percentage 1-septate	Percentage 2-septate	Percentage 3-septate
1. *A. Pisi* (Ind.)	0	97	3	0
2. P.	24	76	0	0
3. *A. Pisi* (Eng.)	0	98	2	0
4. V.	0	98	2	Rare
5. L.	0	97	3	Rare
6. G.	90	10	Rare	0
G. (*N*/25 malic acid)	10	90	Rare	0
7. *P. Rabiei*	94	6	Rare	0
P. Rabiei (*N*/25 malic acid)	15	83	2	0
8. *M. pinodes*	0	97	3	Rare
9. *A. pinodella*	100	Rare	0	0

A. Pisi (Ind.), *A. Pisi* (Eng.), V., L. and *M. pinodes* have a high percentage of 1-septate spores both before and after germination if the spores are mature. If young spores of these forms are used, the percentage of non-septate spores may be considerable, but most (98 per cent.) become 1-septate at germination. The spores of *A. pinodella*, on the other hand, remain practically all non-septate, so that it is difficult to accept this form as a true *Ascochyta*. The fungus P. is very irregular in this respect, at times behaving as indicated in the table but at others giving spores which nearly all remain non-septate. *P. Rabiei* and G. react differently according to the medium, producing a high percentage of 1-septate spores in acid media only. The bearing of these results on the taxonomy of these forms will be discussed in a later section.

E. *Inoculation experiments*

Artificial inoculations of growing plants—in the greenhouse during the winter at the Chelsea Physic Garden, and in the open during the summer at Chelsea and at Slough—have been carried out. During these experiments all the fungi have been at one time or another tested on the following list of plants:

(1) Gram (Punjab type No. 7)—seeds obtained from Punjab.

(2) Lentil—seeds obtained from Punjab.

(3) Pea (var. Sutton's Maincrop)—seeds obtained from Suttons, Reading.

(4) *Vicia sativa* (cultivated vetch)—seeds obtained from Suttons, Reading.

(5) *Vicia sativa* (wild form)—seeds collected at Slough.

(6) Broad Bean (var. Longpod)—seeds obtained from Suttons.

Inoculations were made by one of the following three methods:

(*a*) By spraying the plants with a suspension of spores in water, prepared by scraping off the surface growth of a culture (fifteen to twenty-five days old on oatmeal agar), and filtering this through fine sterilised muslin which holds back the mycelial debris and allows the spores to pass through. An atomiser was used for spraying potted plants and a watering-can for the outdoor plots. The sprayed plants were kept moist by covering them with bell-jars when in pots and with wet straw in the field. These coverings were taken off after two days.

(*b*) By smearing the seeds with spores. The seeds were disinfected by steeping in a 2 per cent. formalin solution for fifteen minutes and then dried. They were then shaken in a dense suspension of spores, left for half an hour and finally sown in sterilised pots of soil.

(*c*) By growing plants in soil infected with the cultures of the various fungi six weeks before sowing seeds.

As the type and magnitude of injury produced vary somewhat with the method of inoculation, it is proposed to describe the three types of experiments separately.

(*a*) *Inoculation by spraying plants with spore suspension.*

Altogether five experiments have been carried out in this manner, viz.:

(1) With potted plants in the greenhouse (Dec. 1930–Feb. 1931).
(2) With potted plants in the greenhouse (Mar. 1931–May 1931).
(3) With potted plants in the open (May 1931–June 1931).
(4) With plants growing in open ground (May 1931–July 1931).
(5) Duplicate of (4).

When plants were grown in the open ground, the rows were isolated from each other by canvas screens.

In the experiment carried out under glass during the winter of 1930–1, the general result was that each fungus was able to parasitise to some extent all the host plants used (gram, lentil, pea and wild vetch), though as a rule not so vigorously as its own host plant. The plants, however, were very pale and drawn as a result of poor light, and little importance is to be attached to the result.

In all the other experiments the plants grew normally. The results obtained were substantially the same in all and are presented in a combined form (Table XI). Though the actual age of the plants at the time of inoculation varied from four to seven weeks in different experiments, the plants were all approximately of the same size. The data of Table XI refer to the state of the plants three weeks after inoculation. The denominators of the fractions give the numbers of plants inoculated; the numerators the numbers which became in-ected. The common type of infection was a leaf spotting. The fungus

P. attacked only old leaves and tendrils. On the other hand the gram plants attacked by *P. Rabiei* and G. were usually completely scorched.

Table XI

Fungus	Gram	Pea	Lentil	Cultivated vetch	Wild vetch
1. *A. Pisi* (Ind.)	6/42	16/16	3/74	0/28	0/20
2. P.	0/46	11/16	0/50	0/25	0/20
3. *A. Pisi* (Eng.)	2/66	22/22	6?/75	0/30	6/26
4. V.	0/48	1/14	6/72	4/26	18/18
5. L.	0/54	1?/16	57/78	0/32	4/16
6. G.	64/64	0/22	0/86	0/28	0/14
7. *P. Rabiei*	64/64	3/18	0/62	0/24	0/22
8. *M. pinodes*	3/16	8/8	1?/12	2/12	2/8
9. *A. pinodella*	6/18	6/8	5?/55	4/27	4/20

It is clear that all the fungi, with the exception of *M. pinodes* and *A. pinodella*, are to a large extent specialised in their parasitism, and that under normal conditions they attack only their natural host plants. The two latter fungi infect gram and vetch also, but the amount of injury caused on these plants is much less than that on pea, their natural host plant.

(*b*) *Inoculation by smearing seeds with spores.*

Two experiments were carried out. The plants were grown in the laboratory (temp. 15–23° C.) and kept under observation for eight weeks. The results of both experiments were similar and showed the almost complete limitation, with two exceptions, of each fungus to its own host plant. The percentage of the natural hosts so infected ran from 70 per cent. to nearly 100 per cent. except in fungus L., which produced little attack even on lentil. The results of the various cross-inoculations were almost uniformly negative.

The two exceptions referred to were *M. pinodes* and *A. pinodella*. Both caused appreciable foot-rot in all the plants tested (including broad bean), particularly on pea. All the inoculated peas were killed while the seedlings were still below ground.

In these experiments a series of uninoculated controls showed a high percentage of germination (80–100 per cent.) and the seedlings were free from disease.

(*c*) *Inoculation by growing plants in infected soil.*

For this purpose a number of pots (60's) were filled with sterilised soil. Cultures of the various organisms (from tubes of oatmeal agar) were then thoroughly incorporated in the soil, one culture being added to each pot. The pots were left at laboratory temperature for six weeks, being watered frequently in the interval. Seeds which had been sterilised on the surface were sown in the pots.

No fungus, with the exception of *M. pinodes* and *A. pinodella*, gave

rise to appreciable infection even on its natural host plant. *M. pinodes* caused severe foot-rot on pea, on about 50 per cent. of the gram plants and to a slight extent on lentil and vetch. *A. pinodella* was severer still in its action, inasmuch as it did not allow many seedlings of pea to come above ground, caused severe foot-rot on all of the gram plants and to an appreciable extent on lentil and vetch.

Thus from all the inoculation experiments by different methods it is evident that all the fungi are highly specialised in their parasitism, with the exception of *M. pinodes* and *A. pinodella*, which are rather unspecialised. These are the only two which gave infection by the soil contamination method.

It is especially noteworthy that spores of all these fungi, when smeared on the seeds of their natural host plants, readily cause infection. This feature is of importance in the natural carry-over of the disease.

IV. Discussion of results

The Indian and English forms of *Ascochyta Pisi* obtained from pea show substantial agreement in their morphological, cultural and pathological features, so that there is no difficulty in considering them as the same organism. A small but steady difference was noted in the matter of growth rate, but this is of little importance.

The forms which have been referred to as V. and L., from vetch and lentil respectively, are closely related to *Ascochyta Pisi*. In general growth relationships they are all very similar, and they agree in the important character of producing a high percentage of bicellular spores, both on the host plant and on cultural media. They therefore all belong to the genus *Ascochyta*. There are however significant differences as shown in the following scheme:

	Sporulation	Aerial mycelium	Spore length
A. Pisi	Abundant	White	12·5–13·5 μ
V.	Scanty	Grey	15·0–17·0 μ
L.	Fair	Mouse-grey	15·0–17·0 μ

Furthermore, each of these three forms is restricted, under natural conditions, to its own host plant, or at most is shown to be very weakly parasitic when cross-inoculations are made.

For these reasons it is suggested that the forms V. and L. should be considered as varieties of *Ascochyta Pisi*. In their general behaviour they lie between typical *Ascochyta Pisi* on pea and the form with larger spores (17–22 μ) on broad bean. Their existence and the possible occurrence of other intermediate forms increase the difficulty of drawing a specific distinction between the forms of *Ascochyta* on pea and bean. The present study thus supports Sprague's (31) view that the form on broad bean is to be considered as a variety of *Ascochyta Pisi*.

The form G., from gram in India, offers no difficulty, inasmuch as it is clearly identical with *Phyllosticta Rabiei*, but it is not so clear that the latter is a proper *Phyllosticta*. Generally, whether growing on its host or in culture, it shows only a very small percentage (less than 2 per cent.) of bicellular spores, but as has been shown, this number may sometimes rise to 12 per cent. on the host. Again, when the spores germinate, a relatively large number (20–90 per cent.) become uni-septate, and as such would definitely be assigned to the genus *Ascochyta*. It is thus clear that this form, like others to be described below, does not belong strictly to either *Phyllosticta* or *Ascochyta* as these genera are understood.

Over and above the difference in spore septation *Phyllosticta Rabiei* differs from *Ascochyta Pisi* in having shorter spores (9–10 μ as against 12·5–13·5 μ). Nevertheless, under conditions of high humidity and on plants at a certain stage of development, the spores of *Phyllosticta Rabiei* may reach the average size of those of *Ascochyta Pisi*. These considerations, in my opinion, explain why the fungus on gram has been confused with *Ascochyta Pisi*, and why it has been moved at one time or other from the one genus to the other.

It may also be noted that as *Phyllosticta Rabiei* attacks leaves, stems, fruits, and occasionally even roots of the host plant, it is not properly a *Phyllosticta* in the sense in which the latter is distinguished from *Phoma*.

The named culture of *Ascochyta pinodella* produces on its host from 5 to 50 per cent. of bicellular spores. In culture the spores are all unicellular and they remain so on germination. Here again is a form which occupies a position intermediate between an *Ascochyta* and a true *Phyllosticta* or *Phoma*.

The fungus P., isolated from pea in India in association with *Ascochyta Pisi*, resembles *Phyllosticta Rabiei* in the septation of its spores, for these are unicellular when taken from the host or from culture but become largely bicellular on germination. On the other hand, it resembles *Ascochyta pinodella* in its general cultural characters and in the small spores. It differs from both these in being only a weak parasite, so far as it has been tested in the present work.

Ascochyta pinodes shows a high percentage of bicellular spores under all conditions and is thus a true *Ascochyta*. It resembles *Ascochyta Pisi* in the size of its spores but differs from it in nearly all its cultural characters. Pathologically it is also distinct, as it has a relatively wide host range, attacking all the host plants tested, pea, gram, lentil, vetch and broad bean. While it has been found to cause leaf-spotting on pea and bean, it is more characteristically associated with the foot-rot phase of the disease, producing in this way severe attack on pea and gram and to a less extent on the other host plants. This fungus and *Ascochyta pinodella* were the only ones which gave infection by the method of soil contamination.

Ascochyta pinodes has the further distinction of producing, both on the host and in culture, the perfect stage *Mycosphaerella pinodes*. In the light of modern research on the existence of heterothallism and homothallism in various groups of fungi, it would be premature to attach too much weight to this distinction, but when everything is taken into account, *Ascochyta pinodes* is to be considered as a good species at the moment.

The behaviour of *Phyllosticta Rabiei*, P. and *Ascochyta pinodella* shows that the line of demarcation between a *Phyllosticta* and an *Ascochyta* is by no means sharp. Ideally a *Phyllosticta* has spores which are 100 per cent. unicellular and which remain so on germination. The ideal *Ascochyta* has spores which are 100 per cent. bicellular, at least when the spores germinate. If these genera are to be preserved, obviously some standard must be adopted for dealing with such intermediate forms as the three fungi in question. *Phyllosticta Rabiei* and P. have spores of which at the most 5–10 per cent. are bicellular when mature and ungerminated. If the small percentage of bicellular spores is ignored, these fungi could be placed in *Phyllosticta*. When, however, germination takes place, many of the spores (up to 75 per cent. and 90 per cent. in P. and *Phyllosticta Rabiei* respectively) of both fungi become bicellular. On this character both might be placed in *Ascochyta*.

Ascochyta pinodella presents the same problem from a somewhat different point of view. On the host it produces spores of which about 5–50 per cent. are bicellular. On this account it has been assigned to *Ascochyta*. Nevertheless, in culture it produces only unicellular spores, which remain non-septate on germination, *i.e.* behave like spores of a true *Phyllosticta*.

In dealing with this question one should, in my opinion, consider only spores obtained from the host. Thus the fact that *Ascochyta pinodella* produces only unicellular spores in culture would be ignored. Further, the maturity of any sample of spores should be determined by a germination test, and only those which germinate should be considered in connection with the degree of septation. On this basis *Phyllosticta Rabiei* (Pass.) Trotter would become *Ascochyta Rabiei* (Pass.) Labrousse, on the basis of the presence of 2–4 per cent. of bicellular spores on artificially inoculated plants. I uphold Labrousse's identification, primarily for the reason that spores of this fungus mostly become bicellular when taken from the host plant and germinated.

Fungus P., isolated from peas in India, is to be considered as an *Ascochyta* for the same reason. It differs from *Ascochyta pinodella* in spore septation, but resembles it in spore size and in most of its cultural characters. It is best considered as a weakly parasitic strain of *Ascochyta pinodella* Jones.

V. Summary

1. Nine fungi causing blight or foot-rot diseases of pea, gram, lentil and vetch (*Vicia sativa*) have been studied.

2. The symptoms of disease and nature of injury caused, as observed on naturally or artificially infected plants, have been described.

3. A comparative study of the various fungi has been made as regards the following:

(i) Morphology on the natural host and on various artificial culture media.

(ii) Response to environmental conditions, such as nature of medium, acidity of medium and temperature.

(iii) Manner of spore germination under a variety of conditions.

4. Inoculation experiments by three different methods under glasshouse and field conditions have been carried out. The main results were:

(i) Each fungus with the exception of *Mycosphaerella pinodes* and *Ascochyta pinodella* is specialised largely to its own host plant.

(ii) *Mycosphaerella pinodes* and *Ascochyta pinodella* are the only ones which cause severe foot-rot.

5. A discussion of the experimental results in relation to the taxonomy of these forms is given, and the following conclusions are reached:

(i) The fungus causing blight of peas in India is typical *Ascochyta Pisi* Lib.

(ii) The fungi isolated from lentil in India and from wild *Vicia sativa* in England are varieties of *Ascochyta Pisi* Lib.

(iii) The fungus causing blight of gram in India is identical with *Phyllosticta Rabiei* (Pass.) Trotter. Reasons are given in support of the transference of this species to *Ascochyta* as *Ascochyta Rabiei* (Pass.) Labrousse.

(iv) *Ascochyta pinodella* Jones and *Ascochyta pinodes* Jones (perfect stage = *Mycosphaerella pinodes* (Berk. & Blox.) Stone) are confirmed as good species and distinct from *Ascochyta Pisi* Lib. and *Ascochyta Rabiei* (Pass.) Labrousse. The two former are characteristically associated with the foot-rot phase of the disease and are both rather unspecialised in their parasitism.

(v) A fungus isolated from peas in India, in association with *Ascochyta Pisi* Lib., is considered to be a weakly parasitic race of *Ascochyta pinodella* Jones.

References

(1) Allescher, A. "Fungi Imperfecti." Rabenhorst's *Krypt.-Flora*, vi (1901), 658.

(2) Berkeley, M. J. "Notices of British Fungi." *Ann. and Mag. Nat. Hist.* Series 1, vi (1841), 355–65.

(3) —— *Outlines of British Fungology* (1860), p. 320.

(4) Bondartzeva-Monteverde, V. N. and Vassilievsky, N. I. "Ascochytosis of the pea and other legumes." *Morbi Plantarum, Leningrad*, xix (1930), 8–11.
(5) Butler, E. J. *Fungi and Disease in Plants* (1918), pp. 268–71.
(6) Ciferri, R. "Notae mycologicae et phytopathologicae." Serie II, N. 1–15. *Riv. Patol. Veg.* xvii (1927), 209–94.
(7) Clark, W. M. *The Determination of Hydrogen Ions* (1923).
(8) Comes, O. *Crittogamia agraria.* Naples (1891), 600 pp.
(9) —— *Crittogamia agraria.* Naples (1891), p. 473.
(10) Cooke, M. C. "Decades of British Fungi." *Journ. Bot.* iv (1866), 97–117.
(11) Currey, F. "Synopsis of the Fructification of the simple Spheriaceae of the Hookerian Herbarium." *Trans. Linn. Soc. Bot.* xxii (1859), 334.
(12) Jones, F. R. and Linford, M. B. "Pea disease survey in Wisconsin." *Wis. Agr. Exp. Sta. Res. Bull.* 64 (1925), pp. 1–31.
(13) Jones, L. K. "The relation of *Mycosphaerella pinodes* to *Ascochyta* blight of pea." *Phytopath.* xvii (1927), 44.
(14) —— "Studies of the nature and control of blight, leaf and pod-spot, and foot-rot of peas caused by species of *Ascochyta*." *N.Y. (Geneva) Agr. Exp. Sta. Bull.* 547 (1927), 46 pp.
(15) Labrousse, F. "L'anthracnose du Pois Chiche (*Cicer arietinum*)." *Rev. Path. Vég. et Ent. Agric.* xvii (1930), 174–7.
(16) —— "L'anthracnose du Pois Chiche." *Rev. Path. Vég. et Ent. Agric.* xviii (1931), 226–32.
(17) Libert, M. A. *Plantae cryptogamicae, quas in Arduenna collegit.* Leodii (1830), Cent. I.
(18) —— *Plantae cryptogamicae, quas in Arduenna collegit.* Leodii (1837), Cent. IV.
(19) Linford, M. B. and Sprague, R. "Species of *Ascochyta* parasitic on the pea." *Phytopath.* xvii (1927), 381–97.
(20) Link, H. F. *Handbuch zur Erkennung der nutzbarsten und am häufigsten vorkommenden Gewächse.* Berlin. Part III (1833), p. 383.
(21) Ludwig, O. "Untersuchungen an *Ascochyta Pisi*." *Beitr. Biol. der Pflanzen*, xvi (1928), 464–510.
(22) Melhus, I. E. "*Septoria Pisi* in relation to pea blight." *Phytopath.* iii (1913), 51–8.
(23) Passerini, G. "Primo elenco di funghi Parmensi." *Comm. Soc. Critt. Ital.* ii (1867), 435–76.
(24) Peglion, V. "Contribuzione alla conoscenza della Flora micologica avellinese." *Malpighia*, viii (1895), 424–60.
(25) Prillieux, E. and Delacroix, G. "Travaux du Laboratoire de Pathologie Végétale." *Bull. Soc. Myc. de Fr.* (1893), p. 273.
(26) Ratschlag, G. "Zur Spezialisierung der auf *Vicia Faba* parasitierenden *Ascochyta*." *Phytopath. Zeitschr.* ii (1930), 483–501.
(27) Saccardo, P. A. *Sylloge Fungorum*, iii (1884), 397.
(28) Scalia, G. *Prima contribuzione alla conoscenza della Flora micologica di Catania* (1899), 25 pp.
(29) —— "I funghi della Sicilia orientale." *Att. Accad. Gioenia di Sci. Nat.* Serie 4, xv (1902), 17 pp.
(30) —— "Sulla *Ascochyta Pisi*." *Staz. Sper. Agric. Ital.* li (1918), 228–42.
(31) Sprague, R. "Host range and life history of some leguminous *Ascochytae*." *Phytopath.* xix (1929), 917–31.
(32) —— "Notes on *Phyllosticta Rabiei* on Chick-pea." *Phytopath.* xx (1930), 591–3.
(33) Stone, R. E. "The life history of *Ascochyta* on some leguminous plants." *Ann. Mycol.* x (1912), 564–92.
(34) Trail, J. W. H. "New Scottish Microfungi." *Scot. Nat.* ix (1887), 86–91.
(35) Trotter, A. "La 'rabbia' o 'antracnosi' del cece ed il suo produttore." *Riv. di Patol. Veg.* ix (1918), No. 7.
(36) Vaughan, R. E. "*Mycosphaerella pinodes*, the ascigerous stage of *Ascochyta Pisi*." *Phytopath.* iii (1913), 71.

REMARKS ON A COLLECTION OF BRITISH SPECIES OF *ROSELLINIA* AND A REDISTRIBUTION OF THE SPECIES OF THAT GENUS

By W. KIRSCHSTEIN

(With 1 Text-figure)

I have examined a collection of British specimens of *Rosellinia* formed by Mr E. W. Mason and have made the following determinations:

Rosellinia aquila (Fr.) de Not. in *Giorn. Bot. Ital.* I (1844), 384, on *Acer* (230), *Corylus* (426, 1119), *Fraxinus* (139, 738), *Ulmus* (129, 1120, 1121).

R. Buxi Fabre, in *Ann. Sci. Nat.* 6 sér. IX (1879), 78, on *Buxus* (15, 368).

R. mammiformis (Pers.) Wint., in Rabenh. *Krypt.-Fl.* II (1885), 226, on *Hedera* (762).

R. ligniaria (Grev.) Nits. in Fuck. *Symb. Myc.* (1869), 150, on *Quercus* (884), *Ulex* (134, 996 to 999, 1198), *Ulmus* (1122).

R. velutina Fuck. Fungi Rhen. no. 2174 (1868), on *Fagus* (647, 1190 to 1193, 1208).

R. Clavariae (Tul.) Wint. in Rabenh. *Krypt.-Fl.* II (1885), 230, on *Clavaria* sp. (1210). Conidial stage only.

Ceratostoma Masoni spec. nov., on *Quercus* (882).

Most of the common species of *Rosellinia* are well represented, and, as is usual, they occur on various hardwood trees with the exception of *R. Clavariae*.

The specimens of *R. aquila* include a good deal of old material without asci and spores, but I have found these structures well developed. The spores uniformly showed the drop-like hyaline appendages which, in my opinion, serve as a diagnostic character for the determination of this species. Neither Winter* nor Schroeter† mentions this character, but Saccardo‡ draws attention to it. I have invariably observed it in mature spores, and it would therefore appear, where it is not mentioned, to have been merely overlooked. The species is rendered conspicuous by the brown, more or less well-developed, subiculum which surrounds the brown, then black and carbonaceous, large, spherical perithecia. There are, however, some closely related species which are most readily distinguishable by their spores. *R. thelena* (Fr.) Rabenh. (not represented in this collection) is distinguished from the foregoing mainly by its spores which are

* Rabenh. *Krypt.-Fl.* II (1885), 224.
† *Krypt.-Fl. Schles.* III, ii (1894), p. 299.
‡ *Syll. Fung.* I (1882), 252.

pointed at both ends, with hyaline, not very long, tapering appendages.

The *Rosellinia* on *Buxus* differs from *Rosellinia aquila* even on cursory examination. The subiculum is darker, thicker and coarser than in that species. Numerous conidia are produced on *Stilbum*-like bodies which originate from the subiculum. The conidia are oval as in *Rosellinia aquila*, but measure only $4–3 \times 5\,\mu$, whereas in the latter species they measure $9 \times 5\,\mu$ according to my measurements, and $8–11 \times 6–7\,\mu$ according to Schroeter. The ascospores are pointed at the ends, as in *R. thelena*, but entirely devoid of appendages, which I could not detect on close examination either on mature or immature individuals. On these grounds *R. Buxi* must stand as a good species.

Fig. 1. *1*, spore of *Rosellinia aquila*. *2*, spore of *R. thelena*. *3*, spore of *R. Buxi*. *4*, spore of *R. mammiformis*. *5*, two asci of *Ceratostoma Masoni*. *6*, three spores of same.

The *Rosellinia* on *Hedera* has no subiculum, and is characterised by its black, somewhat glistening perithecia which are rather smaller than those of the preceding species. I take this to be *Rosellinia mammiformis* (Pers.) Winter. The fairly sharply pointed spores are broader than those of the previous species ($8–9\,\mu$), and have no appendages.

The collection further contains a plentiful supply of *R. ligniaria* (Grev.) Nits. The specimen on *Ulmus* shows, in addition to the normal spores ($12–18 \times 6–9\,\mu$), a few which exceed the normal dimensions of length and breadth—up to $20 \times 11\,\mu$; however, this is no reason for the establishment of a distinct species, since a similar phenomenon has occasionally been observed in other Pyrenomycetes. In Germany *Rosellinia ligniaria* is a fairly widespread fungus on the rotting branches of various trees. The small perithecia are mostly densely aggregated; they are thickly covered with short pointed setae,

and appear velvety under the lens. As I have previously explained*, a number of species have been created that cannot be sharply differentiated, and should be transferred to *R. ligniaria*; for the spore dimensions, on which the separation is always based, often fluctuate considerably, as observed above, even in the same perithecium.

I should, however, retain as a good species *R. velutina* Fuck., which is labelled *R. pulveracea* in this collection. The latter species cannot be that represented here as its perithecia are completely glabrous, whereas the present fungus has some short sparse setae which may, however, be easily overlooked. The spores indeed are similar, but on the average the asci and spores of *R. pulveracea* are larger. The perithecia of *R. velutina* resemble those of *R. ligniaria* in the sharp pointed setae, which are, however, much less abundant in the former. The disciform spores are somewhat elongate, but sometimes present the appearance of being almost globose; this, however, is due to the angle at which they are viewed. This spore-shape and the much smaller dimensions of all parts readily serve to differentiate this species from *R. ligniaria* whose spores are always quite regularly ellipsoid.

The *Clavaria* sp. (1210) bears *Helminthosporium Clavariae* Desm., the conidial stage of *Rosellinia Clavariae* (Tul.) Winter in a good state of development, but I could detect no perithecia. Fuckel created for this species the genus *Helminthosphaeria*, which was also recognised by Saccardo†. He placed it between *Chaetomium* and *Sordaria*. I shall refer again to this genus later.

We finally come to No. 882 of the collection on *Quercus*, which belongs, however, not to *Rosellinia* but to the genus *Ceratostoma*. The diagnosis of this fungus, as yet undescribed, and which I name *C. Masoni* in honour of the finder, will be found at the end of these notes.

In the present system of classification *Rosellinia* is not a uniform genus, since the species of which it is composed vary too greatly in size, structure, and covering of the perithecia. Recognising this, Saccardo created a number of subgenera to facilitate study, but even were these to be raised to generic rank they would not form well-defined groups. Furthermore, the new genera actually belong to different families of the order Sphaeriales. I am here following the classification of Winter in the above-mentioned work, in placing the new genera in four families, viz. Trichosphaeriaceae, Melanommaceae, Amphisphaeriaceae, and Cucurbitariaceae (Winter writes "Trichosphaeriae," etc.). All the species united in Saccardo's subgenus *Coniochaeta*, with small, slender, often coriaceous, hirsute fruit-bodies belong to one already existing genus, namely, Fuckel's *Helminthosphaeria*, which comprises in addition to *Rosellinia Clavariae*

* *Krypt.-Fl. Brand.* VII (1911), 218.
† *Syll. Fung.* I (1882), 230.

all species with the foregoing characters. This genus must be placed in the family Trichosphaeriaceae. Then come the species with small, slender, sometimes coriaceous, smooth perithecia, which Saccardo groups in the subgenus *Coniomela*. They constitute the genus *Coniomela* of the family Melanommaceae. For the forms with larger, carbonaceous, smooth perithecia which, unlike all others, develop within the substratum and remain more or less sunken, Saccardo creates the subgenus *Amphisphaerella*, which I rank as a genus next to *Amphisphaeria* in the family Amphisphaeriaceae. Species with densely aggregated, erumpent perithecia belong to the genus *Cucurbitula* Fuckel which Saccardo erroneously reduced to a subgenus. The genus *Cucurbitariella* Petrak is a synonym. *Cucurbitula* Fuckel belongs to the Cucurbitariaceae.

There now remain all the species with large, coarse, carbonaceous, smooth or rough but hairless perithecia, sometimes occupying an extensive subiculum. Here are included Saccardo's three subgenera, *Eurosellinia*, *Calomastia*, and *Tassiella*, which together would form the genus *Rosellinia*. This classification of the species would, in my opinion, best express their natural relationships. The two genera *Rosellinia* and *Coniomela* come at the head of the Melanommaceae. A further reason for the special position occupied by the newly delimited genus *Rosellinia* is the similarity of many of its species to some of the stroma-forming species of *Hypoxylon*. As an instance *H. pauperatum* Karst. may be cited, which always forms on a very poorly developed stroma only a few perithecia attached to each other solely at the base. This *Hypoxylon* very closely resembles *Rosellinia mammiformis* (Pers.) Wint., and, apart from the subiculum, *R. aquila* (Fr.) de Not., and other species. The asci and spores of these species of both genera are likewise very similar. *Rosellinia* may therefore be regarded as a transitional genus to *Hypoxylon*, *i.e.* from the non-stromatic to the stromatic Sphaeriales.

The following synopsis shows my reclassification of the species of the old genus *Rosellinia*.

Family Trichosphaeriaceae

Genus **Helminthosphaeria** Fuck. *Symb. Myc.* (1869), 166.

Syn. *Coniochaeta* (Sacc.) P. Henn. in *Hedw.* xlii (1903) [80]. *Rosellinia* subgen. *Coniochaeta* Sacc. *Syll.* i (1882), 269.

Species: *H. Clavariae* (Tul.) Fuck., *H. ligniaria* (Grev.) comb.nov., *H. velutina* (Fuck.) comb.nov., *H. palustris* (Schroet.) comb.nov., *H. malacotricha* (Niessl.) comb.nov., *H. tunicata* (W. Kirschst.) comb. nov., *H. sanguinolenta* (Wallr.) comb.nov., and others (see Saccardo, *Syll. Fung.*).

Family Melanommaceae

Genus **Rosellinia** de Not. in *Giorn. Bot. ital.* I (1844), 334.

Species: *R. aquila* (Fries) de Not., *R. thelena* (Fries) Rabenh., *R. fusispora* W. Kirschst., *R. mammiformis* (Pers.) Wint., *R. callosa* Wint., *R. araneosa* (Pers.) Sacc., *R. Buxi* H. Fabre; and others (see Saccardo, *Syll. Fung.*).

Genus **Coniomela** (Sacc.) W. Kirschst.

Syn. *Rosellinia* subgen. *Coniomela* Sacc. *Syll.* I. (1882), 264.

Species: *C. pulveracea* (Ehrh.) comb.nov., *C. Millegrana* (Schw.) comb.nov., *C. Rosarum* (Niessl.) comb.nov., *C. rimincola* (Rehm) comb.nov., and others (see Saccardo, *Syll. Fung.*).

Family Amphisphaeriaceae

Genus **Amphisphaerella** (Sacc.) W. Kirschst.

Syn. *Rosellinia* subgen. *Amphisphaerella* Sacc. *Syll.* I (1882), 262.

Species: *A. amphisphaerioides* (Sacc. & Speg.) comb.nov., *A. protuberans* (Karst.) comb.nov., *A. Arausiaca* (H. Fabre) comb.nov., *A. mycophila* (Fr.) comb.nov., *A. prinicola* (Berk. & Curt.) comb.nov., *A. canicollis* (Karst.) comb.nov., and others (see Saccardo, *Syll. Fung.*).

Family Cucurbitariaceae

Genus **Cucurbitula** Fuck. *Symb. Myc.* (1869), 171.

Syn. *Cucurbitariella* Petr. in *Ann. Myc.* XIV (1916), 440.

Species: *C. conglobata* (Fr.) Fuck., *C. Myricariae* Fuck., *C. Syringae* (Kickx) Lamb., *C. moravica* (Petr.) comb.nov.

In conclusion I append the diagnosis of the new species of the genus *Ceratostoma*.

Ceratostoma Masoni W. Kirschst. spec.nov. Peritheciis plus minus dense gregariis, primum immersis, tum erumpentibus, denique ferme superficialibus, nigris, membranaceo-coriaceis, minute granulatis, deorsum textura hypharum flavescentium cinctis, 250–300 μ diam., in ostiolum fere aequilongum productis; ascis clavato- vel cylindraceo-fusiformibus, supra planis, breviter pedicellatis, octosporis, 180–200 × 20–25 μ; sporidiis oblique monostichis vel medio spatio ascorum distichis, continuis, lato-fusoideis, non acutissimis, primum hyalinis, deinde olivaceis, mono- vel bi-guttulatis, postremo opaco-fuscis, 26–34 × 14–16 μ; paraphysibus hyalinis, filiformibus obvallatis. In *Querco* putrido.

The species is particularly remarkable for its spores resembling plum-kernels. Spores of such dimensions are rare in the genus *Ceratostoma*. Saccardo gives *C. rosellinioides* Rehm, which does indeed possess asci and spores of the same length, but they are only half the width and of a different shape. The perithecia of *C. rosellinioides* are more than three times the diameter of those of *C. Masoni*. (*Syll. Fung.* XVI, 427–28.)

C. querceticolum (Crouan) Sacc. (*Sphaeria querceticola* Crouan (*Syll. Fung.* I, 215–16)) cannot be identical with the foregoing although it also occurs on rotten oak wood, since most of the few characters mentioned do not agree with those of the new species. Moreover, the dimensions of the asci and spores are not given, and not even the colour of the latter. It is impossible to name a species on the basis of such a scanty description. If the diagnosis of the fungus cannot be supplemented from any original specimens that may be available it would be preferable to eliminate *S. querceticola* Crouan altogether.

THE *LICHEN FUCOIDES* OF VARIOUS AUTHORS AND ITS FATE

By O. V. DARBISHIRE

(With Plates XX–XXII)

During the last twenty years many long-established plant names have been replaced by unfamiliar ones. The latter enjoy this privilege by virtue of priority of date of publication as far back as 1753. One of the well-known lichens to have suffered in this way is *Roccella phycopsis* Ach. (*Parmelia phycopsis* Ach., *Arch. f. d. system. Naturgesch.* I (1804), 110). It has borne the specific epithet *phycopsis* since. Just short of a hundred years later, in 1901, Wainio (*Cat. Afr. pl. Welwitsch*, II, 2, 433) incidentally made the following remark when writing of *Roccella Arnoldi* Wainio: "Habitu similis est *R. fucoidi* (Dicks.) Wain. (*Lichen fucoides* Dicks., *Crypt. Fasc.* II, 1790, p. 22 secund. specim. authent. in herb. Ach. ad *R. phycopsin* Darb. vel *R. phycopsin* Ach., *Lich. Univ.* 1810, p. 440 pr.p.spectat), at colore medullae placentae ab ea differt, reactionibus, KHO, $CaCl_2O_2$ et jodo productis, cum ea congruens." A few words must first be added here concerning *Roccella Arnoldi* Wain. Wainio no doubt intended his *Roccella Arnoldi* to include all the soraliferous specimens of *R. tinctoria* DC., and he based the new specific name on the specimens distributed as *Roccella tinctoria* DC. in "Arnold, *Lich. Exsiccati*, no. 1689" (*tom. cit.* p. 433). The latter certainly belonged to *R. tinctoria* DC. (Darbishire, O. V., *Monographia Roccelleorum. Bibliotheca Bot.* (1898), p. 45). Some incomplete specimens of *R. Arnoldi* Wain., named by Wainio himself, are preserved in the Herbarium of the British Museum (Natural History) as "no. 417/pr.p." of Welwitsch's African Plants. I have examined the specimens in question. Though they did not exhibit the characteristic yellow colouring of the basal hyphae, probably owing to their very incompleteness, I had no doubt that they represented specimens of *R. phycopsis* Ach. and accordingly in 1928 (*Pflanzenareale*, II, 4) I referred to *R. Arnoldi* Wain. as a soraliferous state of *R. phycopsis* Ach. In justice to Wainio, however, I feel that I should base my interpretation of his *R. Arnoldi* on Arnold's specimens of *R. tinctoria* DC., for I am certain that these are the real type specimens. I am inclined then to look upon *R. Arnoldi* Wain. as representing soraliferous specimens of *R. tinctoria* DC. But if this is so the above-mentioned specimens at the British Museum would appear to have been incorrectly named by Wainio himself. *R. Arnoldi* Wain. representing then only a special state of *R. tinctoria* DC. cannot be looked upon as

a separate species and must be considered a synonym of *R. tinctoria* DC. In 1916 Coutinho (*Lich. Lusit. Herb. Univ. Olisipensis Catal.*) had correctly interpreted *R. Arnoldi* Wainio as "Planta sterilis thallo soredioso a *R. tinctoria* distincta." In 1923 A. Zahlbruckner (*Cat. Lich. Univ.* II, 518) listed *R. Arnoldi* Wain. as a variety of *R. fucoides* Wain. (=*R. phycopsis* Ach.). I do not see, however, on what grounds he based this transference from *R. tinctoria* DC. as a variety to *R. fucoides* (Dicks.) Wain. as a new combination in 1914 for which he gives no reason (*Denk. K. Akad. Wiss. Wien Math.-Nat. Kl.* XCII, (47), 307).

For the idea of connecting *R. phycopsis* Ach. with *Lichen fucoides* Dicks., Wainio, as he himself states, is indebted to a study of the Herbarium of Acharius which is preserved in the University of Helsingfors. I have not been able to see the "authentic specimen" mentioned by Wainio, but Prof. K. Linkola kindly sent me photographs of the relevant herbarium sheet, labelled "*Roccella phycopsis*." Some of the specimens on this sheet apparently do not belong to *R. phycopsis* Ach., but one is labelled "Anglia" in ink, and "*L. fucoides* Dicks." in pencil (Pl. XXII). This presumably is the "authentic" specimen of Wainio. It certainly belongs to *R. phycopsis* Ach., and apparently was identified by Acharius with the *Lichen fucoides* of Dickson. Dickson distributed a "Collection of dried plants, named on the authority of the Linnean Herbarium," during the period 1789–91, and also a "Hortus Siccus Britannicus" during 1793–1802. In neither of these collections was any specimen issued under the name of *Lichen fucoides* (according to Lynge in *Nyt. Mag. f. Naturv.* LIV (1916), p. 160). Dickson may have sent Acharius the specimen in question, by way of exchange or gift. There is nothing now to show how the specimen came to be labelled "*L. fucoides* Dicks." The writing is clearly old and may have been that of Acharius (Pl. XXII).

Already in 1803 Acharius (*Methodus*, p. 262) refers to "*Lichen fucoides* Dicks. Cr. Br. 2, p. 22 & Dill. T. 22, fig. 60," in a note on *Parmelia scopulorum* (*Ramalina siliquosa* (Huds.) A. L. Sm.), to which, he adds, Withering thinks that *Lichen fucoides* belongs, but Acharius then remarks "sed descriptio Dicksonii satis differt & speciem *Parm. fuciformi* [=*Roccella fuciformis* (L.) DC. of to-day] propinquiorem exprimere videtur. Addit Dickson quod figurae Dillenii ex speciminibus imperfectis desumtae sunt." In 1804 Acharius (*Archiv f. d. System. Naturgesch.* I, 110) creates the name "*phycopsis*" by the following bare statement: "*Parmelia phycopsis* (*Polymeria*) (*Lichen fucoides* Dicks., Fasc. II, 22; *With. Arr. Confer. Meth. Lich.* p. 262)." There seems no reason here for replacing the old name by a new one without adding an amended diagnosis. It may at the time have been the intention of Acharius to do so. In 1810 in his *Lichenographia Universalis* he did in fact publish a full diagnosis of this species under a new genus as

Roccella phycopsis: "R. thallo caespitoso albido-cinerascente ramosissimo teretiusculo, ramulis extimis abbreviatus fastigiatis; sorediis sparsis planis submarginatis." He quotes the same synonyms as in 1804. Curiously enough he concludes his remarks on *R. phycopsis* by making an error when he adds: "ambigit inter *R. tinctoriam* et *fucoidem* [sic], sed jure ad neutram harum ut varietas referri potest." He intended to refer to "*fuciformis*" and not to "*fucoides*."

Now let us compare this diagnosis of *R. phycopsis* by Acharius with that of *Lichen fucoides* by Dickson (*Plant. Crypt. Brit.* II, 22): "Lichen fucoides foliaceus ramosissimus albidocanescens, ramis fasciculatis teretibus: ramulis abbreviatis fastigiatis subulatis obtusiusculis tuberculis lateralibus planiusculis farinaceis. Habitat in rupibus et lignis, locis marinis, prope Gosport. Obs. Multum affinitatis habet cum *Lichene fuciforme*, attamen cum illo conjungere non possumus, ob notas plurimas diversas. Dillenii figura ex imperfectis speciminibus desumta est." Dickson's description certainly in part covers *Roccella phycopsis* Ach., as he mentions the terete and fasciculate branching. But *R. phycopsis* Ach. cannot correctly be described as foliaceous. This term would apply more accurately to *R. fuciformis* (L.) DC., the podetia of which are not typically terete. Even when the podetia of *R. phycopsis* are not quite cylindrical in section but slightly oval or flattened they cannot ever be called leaf-like. Throughout his diagnosis Dickson seems to see affinity with *R. fuciformis* more than does Acharius who considers that *R. phycopsis* has a place between *R. tinctoria* and *R. fuciformis*. The diagnosis of Acharius seems to me to be the more accurate.

Another difficulty arises with the quotation by both Acharius and Dickson of certain figures in Dillenius (*Hist. Musc.* Tab. 22, Fig. 60 A–C, Pl. fig. 4 (1741)) and for the following reason. These figures were studied by Crombie in 1880 (*Journ. Linn. Soc.* XVII, 570) who claims that they all belong to *R. fuciformis* (L.) DC., adding: "Various states stunted and infertile. Erroneously referred by Acharius in Syn. p. 224 [p. 244], to *R. phycopsis*, but rightly identified by Fries." Crombie rests his interpretation on an examination of specimens in the Dillenian Herbarium which is in the possession of the University of Oxford. The above critical remarks by Crombie refer only to Acharius's quotation of Dillenius's Fig. 60 on Tab. 22 and its relegation by Acharius to *R. phycopsis* and not to the latter's mention of Dickson's *Lichen fucoides*. The remark by Crombie "rightly identified by Fries" refers to the latter relegating the Fig. 60 as a variety to *Roccella fuciformis* (L.) DC. (*Lich. Europ. reform.* 1831).

Through the kindness of Prof. Tansley I was able to examine the specimens in the Dillenian Herbarium from which Dillenius drew his figures (Pl. XX, fig. 2 and Pl. XXI, fig. 3). There is no doubt that all the specimens on which his Figs. 60 and 61 on Tab. 22 are based belong to *R. fuciformis* (L.) DC., as has already been stated by

Crombie. The specimens from which his Fig. 60 was drawn are small it is true but not stunted. By colour, flattened and leaf-like frond, and general appearance they clearly all belong to *R. fuciformis* (L.) DC. Both Dickson and Acharius were at fault in quoting these figures of Dillenius to illustrate their species "*fucoides*" and "*phycopsis*" respectively. They were misled by the badly executed drawings. We cannot even be sure that Acharius actually saw the figures. It seems to me that the specific epithet "*fucoides*" of Dickson (1790) is not sufficiently well and accurately defined to replace "*phycopsis*" of Acharius (1810). For that reason I consider that the specific name of the plant in question should be based on the better diagnosis of Acharius and not on that of Dickson. It should be called *R. phycopsis* Ach. and not *R. fucoides* (Dicks.) Wain. At the same time there is no doubt that the plant marked "*L. fucoides* Dicks." in the Herbarium of Acharius is a typical specimen of *Roccella phycopsis* Ach. Even if this specimen could be identified as an authentic specimen of the *Lichen fucoides* of Dickson I do not, in view of the not too accurate diagnosis of Dickson, consider that there is sufficient justification for taking over again "*fucoides*" in place of "*phycopsis*."

It is on Wainio's statement quoted above that the adoption by many lichenologists of *Roccella fucoides* (Dicks.) Wain. in place of *R. phycopsis* Ach. is founded. Except however for the solitary instance already mentioned, I have been unable to find any published paper in which Wainio himself makes use of the combination *R. fucoides* (Dicks.) Wain. instead of *R. phycopsis* Ach. In 1924 (*Kong. Dansk Videns. Selsk. Skrift. naturvid. og mathem. Afd.* VI, 397) he uses the latter name in some notes on his new species *R. Boergesenii* Wain. It seems almost as if he had changed his mind, abandoned *R. fucoides* (Dicks.) Wain. and again adopted *R. phycopsis* Ach.; he had said originally of *Lichen fucoides* "pr. p. spectat," meaning that *Lichen fucoides* Dicks. referred only in part to *Roccella phycopsis* Ach.

In *Ann. Naturhist. Hofmuseum, Wien*, XIX, 413 (No. 1027 *a*) (1904), Zahlbruckner had already adopted the name *R. fucoides* (Dicks.) Wain. in place of *R. phycopsis* Ach. In his *Catalogus Lichenum Universalis*, 1924, he wrote the name as *R. fucoides* Wain., but he apparently no longer considered that Dickson had invented the specific epithet but that it was due to de Necker in 1771 (*Method. Musc.* p. 76). The description of *Lichen fucoides* given by de Necker reads: "Lichen fucoides fronde orbiculata, marginibus fimbriatis, atrovirente, pellucida." De Necker illustrates his species by reference to a figure by Dillenius (Tab. 29, Fig. 116). This figure (Pl. XX, fig. 1) clearly is not drawn from a specimen of any species of *Roccella*. In 1803 and 1810 Acharius quotes the same figure as belonging to *Gyrophora cylindrica* (L.) Ach., a view now generally accepted. This reference to *Lichen fucoides* de Neck. as a synonym of *Roccella fucoides* (Dicks.) Wain. is obviously only an accidental error.

The following very briefly is the story of the *Lichen fucoides* of Latourrette and the *Lichen fucoides* of Wulfen, the various names being connected by the synonymy:

1772 or 1776. *Lichen normoericus* Gunn., *Flora norvegica*. The date lies between 1772 and 1776 and not 1766, as given by Du Rietz, *Ark. f. Bot.* xx (1926), 39.

1777. *Lichen corniculatus* Lightft., *Flor. Scot.* II, 885.

1778. *Lichen tristis* Web., *Flor. Goetting.* p. 209.

1784. *Lichen fucoides* Latourrette (*Chloris Lugdunensis, C. Linnaei Systema Plant. Europ.* ed. Gilibert, 1785); "tristis Web." is here quoted as a synonym.

1786–1790. *Lichen fucoides* Wulf., in Jacquin, *Collect. Bot. Chem. et Hist. Nat. spect.* p. 143. I can find no evidence that Wulfen had any knowledge of the *Lichen fucoides* of Latourrette.

1791. *Lichen fucinus* Gmelin (*System. Natur.* ed. Gmelin, II, 2, p. 1378).

1810. *Cornicularia tristis* (Web.) Ach. and var. *C. fucina* (Gmel.) Ach. (*Lichenogr. Univ.* p. 611). As a synonym of the variety Acharius quotes *Lichen fucoides* Wulf. ap. Jacq.

1831. *Cetraria tristis* (Web.) Fr. (*Lichenogr. Europ. reform.* p. 34).

1918. *Parmelia corniculata* A. L. Sm. (*Monogr. Brit. Lichens*, I, 124).

1921. *Cetraria normoerica* (Gunnerus) Lynge (*Kong. Norske Vidensk. Selsk. Skrift.* No. 3, p. 185).

1926. *Cornicularia normoerica* (Gunn.) DR. (*Arkiv f. Bot.* 39).

1930. *Cornicularia normoerica* DR. f. *fucoides* Zahlbr. (*Cat. Lichen. Univ.* VI, 414). The "*fucoides*" of this form is that due to Wulfen mentioned above.

Incidentally and indirectly another matter may be said to arise here. Zahlbruckner (*Cat. Lich. Univ.* II (1923), 515) mentions *Roccella Dillenii* Bory. This name dates back to 1828 (*Dict. Class. Hist. Nat.* XIV), but Bory de St Vincent does not supply a figure of his new species but refers to Dillenius, and quotes at any rate two of the figures to which Dickson referred in illustration of his *Lichen fucoides*, namely Fig. 60 B and C on Tab. 22 (*Hist. Musc.* p. 167). There exists no full diagnosis of *R. Dillenii* Bory. Bory himself writes only: "Cette espèce, confondue avec la suivante, [this is *R. fastigiata* Bory which appears to belong to *Roccella tinctoria* DC., according to Zahlbruckner (*Cat. Lichen. Univ.* II, 524) and, with some hesitation, myself (*Bibl. Bot.* XLV, 32)] en est certainement bien distincte; c'est celle qui semble être propre aux rives de la Méditerranée. Desfontaines l'a rapportée de Tunis, Soleirol de Corse; nous l'avons des côtes de Provence; et Don Simon de Rojas y Clemente la trouva au Cap de Gates en Andalousie" (*Dict. Class. Hist. Nat.* XIV, 631). I have made every endeavour to trace further records of this species and to see type specimens, but have been unsuccessful. I would therefore consider this name to be a *nomen nudum*.

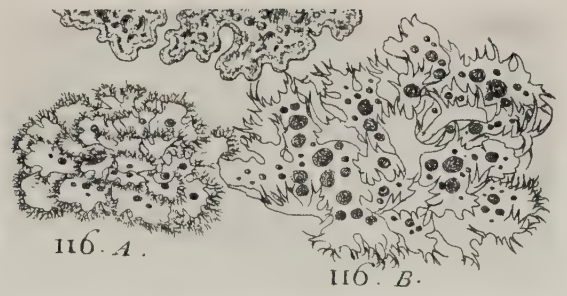

116. A.
116. B.

Fig. 1

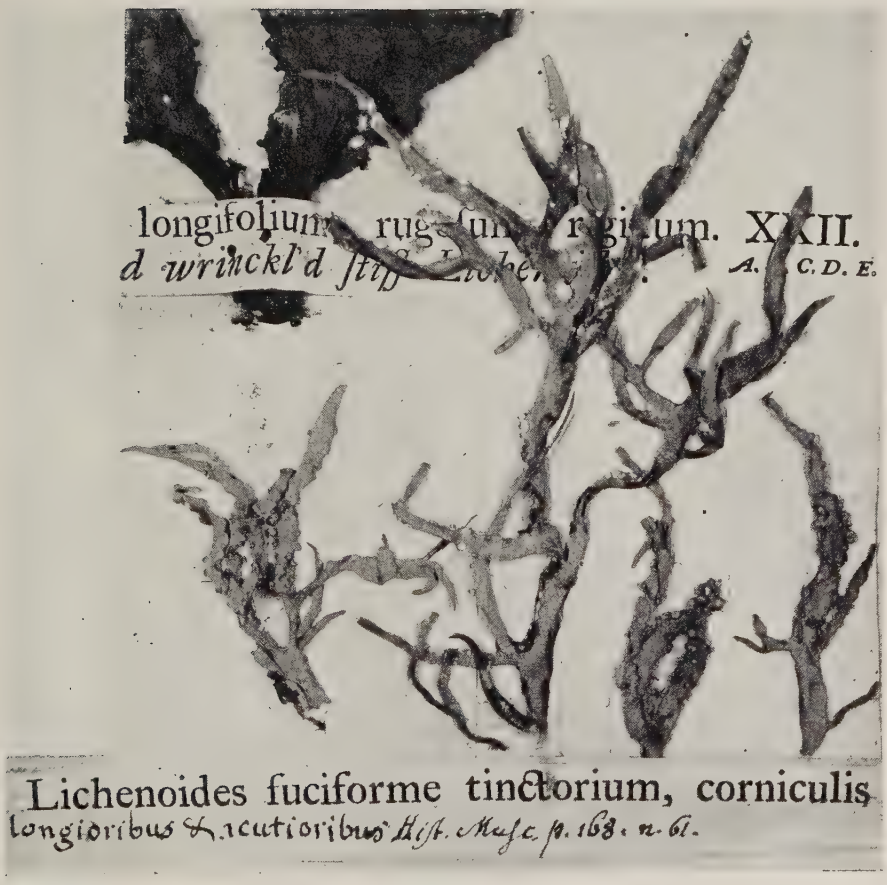

longifolium rug[un]r[ug]ium. XXII.
d wrinckl'd
A. C. D. E.
Lichenoides fuciforme tinctorium, corniculis
longioribus & acutioribus Hist. Musc. p. 168. n. 61.

Fig. 2

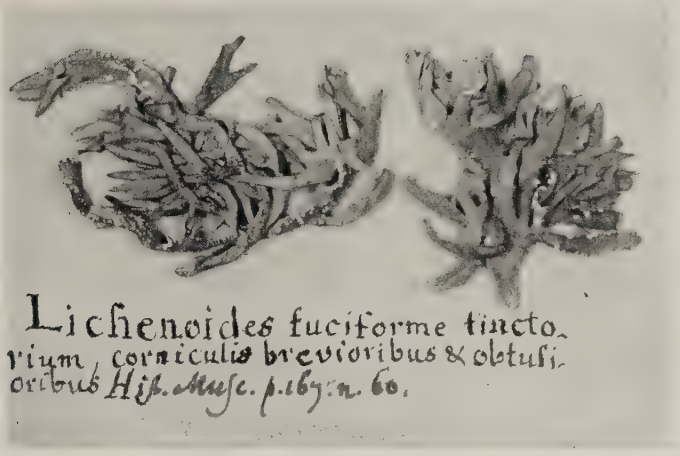

Lichenoides fuciforme tinctorium, corniculis brevioribus & obtusioribus Hist. Muse. p. 189. n. 60.

Fig. 3

A.
60.A
60.B
60.C
61.A.
61.B.

Fig. 4

Gallia
Inf. Francia.
Anglia.
Cap. b. Sp.
Ind. Or.
β. digitata.
Roccella phycopsis.

Summary

1. *Lichen fucoides* de Neck. (1771) is a synonym of *Gyrophora cylindrica* Ach.

2. *Lichen fucoides* Latourrette (1785) is a synonym of *Cornicularia normoerica* (Gunn.) DR.

3. *Lichen fucoides* Dickson (1785) is not sufficiently well defined to replace *Roccella phycopsis* Ach., of which it represents a pr. p. synonym.

4. *Lichen fucoides* Wulfen (1786) is now *Cornicularia normoerica* (Gunn.) DR. f. *fucoides* (Wulf.) A. Zahlbr.

5. *Roccella Dillenii* Bory should be looked upon as a *nomen nudum.*

6. *Roccella Arnoldi* Wain. includes the soraliferous specimens of *R. tinctoria* DC. and should therefore be looked upon as a synonym of this species merely.

7. The Figs. 60 and 61 on Tab. 22 in the *Historia Muscorum* of Dillenius are all drawn from specimens of *Roccella fuciformis* (L.) DC. lying in the Dillenian Herbarium. They should be used only to illustrate that species however badly they may have been drawn.

I wish to express my thanks to Dr Sprague (Kew) and the Librarian of the Linnean Society (London) for rendering me useful help in bibliographical matters, also to Prof. K. Linkola (Helsingfors) and Prof. A. G. Tansley (Oxford). Thanks are likewise due to the Bristol University Colston Research Society for a grant towards the cost of printing the plates which illustrate this paper, the photographs for which were efficiently taken by Mr E. Hopkins.

EXPLANATION OF PLATES XX–XXII

Plate XX

Fig. 1. "Lichenoides corneum marginibus eleganter fimbriatis," from Dillenius, *Hist. Musc.* (1741), p. 218, Tab. 29, Fig. 116.

Fig. 2. "Lichenoides fuciforme tinctorium, corniculis longioribus et acutioribus." Photograph of specimens from the Herbarium of Dillenius (preserved in Botany Department at Oxford).

Plate XXI

Fig. 3. "Lichenoides fuciforme tinctorium, corniculis brevioribus et obtusioribus," preserved at Oxford.

Fig. 4. Photograph of Figs. 60 and part of 61 from Tab. 22 in Dillenius, *Hist. Musc.*

Plate XXII

"*Roccella phycopsis.*" Photograph of a sheet from the Herbarium of Acharius, preserved in the University of Helsingfors. The specimen of the left marked "Anglia" in ink, and "*L. fucoides* Dicks." in pencil is unmistakably *Roccella phycopsis* Ach. The specimen marked "Ind. Or." certainly does not belong to *R. phycopsis* Ach. It bears big apothecia with a definite white margin resembling those of *R. tinctoria* DC. rather more than the supposed apothecia of *R. phycopsis* Ach.

Note. The photographs in Pls. XX, XXI are taken about the natural size of the originals. That of Pl. XXII is probably slightly reduced.

NOTES ON MYCOLOGICAL NOMENCLATURE

By J. RAMSBOTTOM

I

The late Dr A. B. Seymour in his *Host Index of the Fungi of North America* (1929) says (Preface, p. ix, footnote): "In this work, S. F. Gray's *Natural Arrangement of British Plants*, 1821, is considered to be later than Fries, *Systema Mycologicum*, also 1821. In practice Persoon's *Mycologia Europaea*, 1822–8, must be considered as the date of departure for some groups published in the later volumes of Fries, according to our interpretation of the rules."

From this it seems clear that Seymour interpreted the Rules as stating that the starting-point for the nomenclature of some groups of fungi is the *date* 1821, in spite of a little uncertainty about the effect of Gray's work, got over by assuming that it post-dates Fries.

Art. 19 of the International Rules of Botanical Nomenclature reads: Botanical nomenclature begins for the different groups of plants (recent and fossil) at the following dates:

(*a*) Phanerogamae and Pteridophyta, 1753 (Linnaeus, *Species Plantarum*, ed. 1).

(*b*) Muscineae, 1801 (Hedwig, *Species Muscorum*).

(*c*) Sphagnaceae and Hepaticae, 1753 (Linnaeus, *Species Plantarum*, ed. 1).

(*d*) Lichenes, 1753 (Linnaeus, *Species Plantarum*, ed. 1).

(*e*) Fungi: Uredinales, Ustilaginales and Gasteromycetes, 1801 (Persoon, *Synopsis methodica Fungorum*).

(*f*) Fungi caeteri, 1821–32 (Fries, *Systema mycologicum*).

(*g*) Algae, 1753 (Linnaeus, *Species Plantarum*, ed. 1). Exceptions: Nostocaceae homocysteae, 1891–3 (Gomont, *Nostocaceae homocysteae*); Nostocaceae heterocysteae, 1886 (Bornet et Flahault, *Nostocaceae heterocysteae*); Desmidiaceae, 1848 (Ralfs, *British Desmidiaceae*); Oedogoniaceae, 1900 (Hirn, *Monographie und Ikonographie der Oedogoniaceen*).

(*h*) Myxomycetes, 1753.

There can be no denying that the article says that botanical nomenclature begins at certain dates, but it will be seen that in (*f*) Fungi caeteri, and (*g*) Nostocaceae homocysteae, the dates are ambiguous. There seem to be three possible interpretations of the Article.

(1) The date (*i.e.* year) is the important point.

(2) As in (1), but a start is not made until the mentioned work appears.

(3) The work itself is the important point, the date being significant only in so far as it specifies the work from which nomenclature begins.

At first sight it might appear that the question is only whether, say, the nomenclature of Uredinales, etc., begins on January 1st, 1801 (1), or on the appearance of Persoon, *Synopsis methodica Fungorum* in that year ((2) and (3)). As probably most systematists would interpret the article as meaning the second of these alternatives, it may seem that there is no point in attempting to distinguish between (2) and (3) as they lead to the same result.

The original intention was to begin botanical nomenclature at the earliest possible date. This was the introduction of the binary system by Linnaeus in his *Species Plantarum*. The date of this work happened to be 1753. When cryptogamists decided that the *Species Plantarum* was not a satisfactory starting point for some groups other works were proposed; this accounts for the late date (1900) for Oedogoniaceae.

Mycologists for certain reasons chose two works—Persoon's *Synopsis* and Fries's *Systema*. There is no difficulty with the former as we have seen above. With the latter, however, we are faced with several difficulties. In the first place there can be no doubt that it is the *Systema* itself that is intended to be the starting point, for otherwise the dates 1821–32 would be inexplicable and meaningless.

To anyone understanding the great influence Fries had on the study of mycology—analogous in many ways to that of Linnaeus on vascular plants—there are obvious reasons why the *Systema* should be the main starting point of mycological nomenclature. It is certain, however, that the practical difficulties were not properly considered when the Article was drawn up. How is it to be interpreted? As I read it, the different groups (Fungi caeteri) have generally as their starting points the dates at which they were first treated in the *Systema*. Thus *e.g.* the Discomycetes (Elvellaceae) will begin at vol. II, 1 (1822) but odd genera like *Rhytisma* are in vol. II, 2 (1823) and *Geoglossum* and its allies in vol. I (1821). The Basidiomycetes (*f*) for the most part are in vol. I (1821), but others, *e.g.* Tremellinaceae, are in vol. II, 1 (1822). Further, some Basidiomycetes such as *Ditiola*, *Solenia* and *Cyphella* are regarded as Discomycetes—and Pyrenomycetes and Sphaeropsideae are grouped together in vol. II, 2 (1823). Without going into details it may be said that the nomenclature of Basidiomycetes begins in vol. I (1821), that of Discomycetes in vol. II, 1 (1822), that of Pyrenomycetes in vol. II, 2 (1823), that of Phycomycetes in vol. III, 2 (1832), that of Sphaeropsideae in vol. II, 2 (1823) and Hyphomycetes in vol. III, 2 (1832), but that certain genera and groups of genera are found in wrong systematic positions. The logical method of dealing with these last would be to date them from their mention in the *Systema*.

To revert to Seymour's note. According to the above view, if

Gray's *Natural Arrangement* was published before the first volume of Fries's *Systema* it does not enter into consideration for Fungi caeteri. If published later it, like Persoon's *Mycologia Europaea*, counts only for the genera or species already treated in the *Systema*.

It is to be hoped that at the next International Congress it will be considered whether it is wise to retain the *Systema* as a starting point, because of the difficulty in interpreting Article 19 (*f*) in a uniform manner.

II

A further complication encountered in dealing with the dates of Fries's *Systema Mycologicum* warrants a separate note. It is well known that two supplementary volumes of the *Systema* were published with the title *Elenchus Fungorum* in 1828: in fact the Index Alphabeticus of the *Systema* serves for the *Elenchus* also (see title page to the Index, vol. III).

The publication of the supplement before the third volume, *i.e.* within the period 1821–32, necessitates that it be considered as part of the *Systema*.

The full title is *Elenchus Fungorum, sistens commentarium in Systema Mycologicum*. There is a "Ratio operis" of six pages, and a page of "Errata typographica correcta" to the two volumes.

It is not generally known that this work was also issued definitely as a supplement to the *Systema*, the title page being a repetition of that of the *Systema* (vol. I) with the addition "Supplementa voluminis" "Primi" and "Secundi." The date, however, is 1830. The pagination of the two is the same and so far as I can see there is no difference except that (in my copy) the preface and page of corrections are omitted: the corrections have not been made in the text and, from a comparison of the type, it is obvious that there has been simply a reissue with a new title page.

To prevent misunderstanding it would be advisable to state clearly that the *Elenchus*, 1828, is to be regarded as part of the *Systema*.

III

In the present volume of the *Transactions* (p. 158) Mr S. P. Wiltshire writes "*Alternaria Cheiranthi* (Fr.) Bolle excluding specimen."

Many phanerogamic systematists have adopted this method of overcoming a difficulty that will probably be discussed at the next International Botanical Congress. While not wishing to prejudice the issue in any way I think it would be well that mycologists should consider the matter from their own point of view.

We may discuss the alternatives from the example given by Wiltshire. He puts one view very clearly. "Although Bolle did not have the correct *M*[*acrosporium*] *Cheiranthi*, the diagnosis she had in mind in

making the new combination was that of the true species and therefore Bolle's name should stand."

According to this view, Bolle recognising that *Macrosporium Cheiranthi* Fr. was an *Alternaria* transferred it to *Alternaria* as *A. Cheiranthi*. The name of the fungus must therefore be *A. Cheiranthi* (Fr.) Bolle; if there has been a mistake in identification it does not matter so far as the name is concerned, an "incidental" transference has been made; some phrase is added such as "excluding specimen" or "as to name only."

Among the advantages of this method of dealing with the difficulty is the fact that the transference is made once for all. Many phanerogamists believe that the specific name being fixed by a type specimen it is sufficient to have the species transferred to its proper genus. In any other method it would be necessary to examine the specimens described by the later author to ascertain whether or not they are the same species. Further there is some difficulty with homonyms.

Nomenclature and taxonomy are admittedly distinct disciplines, but it is illogical to divorce nomenclature from taxonomic facts: we cannot deal only with names unless we have the facts accepted. This is not to say that it may not be expedient to deal with transfers in the above manner. Nomenclature of itself is a sterile pursuit: its only botanical justification is that it serves the purposes of taxonomy. To carry out the aims and objects of nomenclature we need rules—and exceptions to them.

Is it expedient for mycologists to solve the difficulty in the above way? What is the alternative? Bolle recognised that Fries's description referred to a species of *Alternaria*. If she had gone no further it would have been correct and logical to write the name *A. Cheiranthi* (Fr.) Bolle. She would have been dealing solely with Fries's description (or specimen). So far all would be agreed.

It is the next step which causes trouble. She had a fungus which she thought was the same as that described by Fries and used his specific epithet. She gave a description and drawings from which it was possible for Wiltshire to decide that she was mistaken in her identification. She also had cultures but these are now sterile. To be able to use the name *A. Cheiranthi* (Fr.) Bolle one must add that it is only the name that is intended—her specimen, culture, description and drawings must be excluded.

With the general adoption of the type method the specific epithet is stabilised: here the specific epithet *Cheiranthi* is stabilised for the fungus described by Fries as *Macrosporium Cheiranthi*. We must have regard either to a type specimen or to the original description. By the method of double citation usual in mycology, and now to be generally adopted in botanical nomenclature, the name of the author responsible for the specific epithet is given in brackets. Zoologists

would write the name of the present species *Alternaria Cheiranthi* (Fr.), disregarding the authority for the transference: botanists give the author of the transference and it has to be decided which authority should be used. What does the second authority signify—the transference of an epithet of a species, or the species itself? The relevant Articles of the Rules read:

Art. 40. For the indication of the name or names of a group to be accurate and complete, and in order that the date may be readily verified, it is necessary to quote the author who first published the name or combination of names in question.

Art. 43. When in a genus, a name is applied to a group which is moved into another group where it retains the same rank, or to a group which becomes of higher or lower rank than before, the change is equivalent to the creation of a new group and the author who has effected the change is the one to be quoted. The original author can be cited only in parenthesis.

Both views can gain support from Art. 43. Both views moreover would hold that we are not dealing only with names or new combinations, and that an author does not merely transfer an epithet, for he must have regard to a description if not to a specimen.

On the second view "*Alternaria Cheiranthi* (Fr.) Bolle" refers to the fungus Bolle described and whether she rightly used Fries's specific epithet or not depends upon whether she had his fungus. If she had Fries's fungus the name is correct: if not she cannot legitimately use his specific epithet.

Microscopic fungi were usually very inadequately described by earlier workers and it is customary for modern mycologists to give revised and augmented descriptions. Thus few will refer to Fries's original description but will consult those of Bolle and Wiltshire. The description of *A. Cheiranthi* (Fr.) Bolle will be looked for in Bolle's writings and no reference will be found there to the fact that her account has to be neglected as she was mistaken in her identification. Those who have read Wiltshire's paper will, on the other hand, use his description. Further when the name is used in Wiltshire's sense it will be necessary to qualify it in the manner he does or there will be further confusion.

We are dealing with two fungi and consequently must have two names. One fungus is *Macrosporium Cheiranthi* described by Fries with an augmented description by Wiltshire: the other was fully described by Bolle. The first is *Alternaria Cheiranthi* (Fr.): the second has no right to this name.

It is open to argument whether in fact Bolle transferred the first species to *Alternaria*. She intended to do so, but what she did was to describe as an *Alternaria* a fungus she had; what if either

the fungus she had, or the fungus she thought she had, was not an *Alternaria*?

Whatever Bolle had in mind it is confusing to use her name as the "author of" the species.

Having regard to the two fungi the nomenclature would be:

(1) *Macrosporium Cheiranthi* Fr., *Alternaria Cheiranthi* (Fr.) Wiltshire.

(2) *Alternaria Cheiranthi* Bolle.

Unfortunately by the Rules passed at Cambridge *A. Cheiranthi* (Fr.) Wiltshire would be rejected as a later homonym. But *A. Cheiranthi* (Fr.) Bolle is a *nomen confusum* or a *nomen ambiguum*, and it would seem necessary to modify the Rules in some way so that such a name applied in error should not interfere with the progress of taxonomy.

The above discussion has not taken account of the fact that Fries based his description on *Helminthosporium Cheiranthi* Libert "apud Desmaz! exs. n. 213" which must therefore be regarded as his type, or that Bolle "provisionally identified an *Alternaria* found by her... with *Macrosporium Cheiranthi*...on the ground that it agreed with the *Alternaria* constituting the bulk of Rabenhorst's *Fungi Europaei*, No. 1360." A point on which stress might also have been laid, if the fungus under consideration was being treated as a special case, is that as the generic names *Alternaria* and *Macrosporium* are regarded as synonymous the transfer is in effect only the alteration of the generic name.

STUDIES IN THE GENUS *USTULINA*—WITH SPECIAL REFERENCE TO PARASITISM

I. INTRODUCTION, SURVEY OF PREVIOUS LITERATURE AND HOST INDEX

By W. H. WILKINS, M.A.

(*Senior Demonstrator and Mycologist in the University Department of Botany, Oxford*)

Introduction

Though *Ustulina vulgaris* is a fungus commonly recorded by field workers in mycology, it has, up to the moment, received little attention from the standpoint of its parasitism. In many parts of this country it is found constantly on beech (and rarely on other deciduous trees), and the appearance of those trees on which the fructifications of *Ustulina* are abundant is often such as to suggest that the fungus is perhaps not so harmless as is generally assumed.

This connection between the presence of fructifications and an apparently diseased condition of the tree has often been noted by the writer when doing field work in mycology, and interest in this aspect was further stimulated when a lime tree, which was brought down by the wind in the Botanic Gardens at Oxford, appeared to have been diseased completely and solely by *Ustulina*; this was, in fact, the starting-point of the present investigation into the pathologic status of the genus.

As lime is a tree comparatively immune to disease, it is not suggested that this one case establishes *Ustulina* as a common pathogen of the lime; on the contrary, attacks of this kind appear to be very unusual. Opportunity to examine certain beech trees, however, tends to emphasise the fact that here, at any rate, further investigation is fully justified. Such investigation is at present being carried on by the writer in the Mycology Laboratory of the above Department.

This first paper—which is by way of being a preliminary notice—purports to deal only with previous literature on the subject and includes also a list of hosts on which *Ustulina* has been recorded by other investigators.

Survey of previous literature

From the immediate standpoint of host relationships, the literature of the more widely known and presumably more economically important species of *Ustulina* falls into three more or less clearly defined periods.

The first of these may be considered as extending from the original mention by Micheli (1729) up to about 1907, during which period the species, under various names such as *Sphaeria maxima* Hall. (1768), *S. deusta* Hoff. (1787) and *Hypoxylon ustulatum* Bull. (1791), was reported from many temperate regions, particularly Europe. It was also recorded as occurring in tropical countries together with a supposedly different species, *Sphaeria zonata* Lév. (1845). The genus *Ustulina* having been established by Tulasne (1863), the subsequent tendency has been to regard the original species (now known as *U. vulgaris* Tul.) as a temperate form and to regard the newer species (*U. zonata* Lév.) as a tropical form. In the majority of references there is a regrettable absence of any mention of the host but, even so, it has been said to grow on some twenty hosts such as beech, elm, oak, *Citrus*, bamboo, etc. The saprophytic aspect has usually been taken for granted, the only exceptions being the doubt about its being injurious to trees, expressed by Wehmer (1896), and the statement by Penzig (1882) that it is parasitic on *Citrus*.

In contrast to the first, the second period is characterised by the rise of *Ustulina*, particularly *U. zonata*, to the position of a pathogen of economic importance. This period is introduced by the work of Petch (1907), who showed that the tropical species was responsible for root disease of tea in Ceylon and suggested that the temperate form on beech must also be regarded as a parasite. The pathogenic status of the tropical form was confirmed by many other workers and dangerous parasitism has been recorded for about forty hosts, of which the most important are such plants as tea, rubber, cocoa, coffee, etc. In spite of the fact that, during this period, many new hosts from temperate climates have been added to the previous list, no further evidence as to the parasitism of this form as suggested by Petch (1907), emphasised by van Overeem (1924) and referred to by Ramsbottom (1932), has been produced.

In my opinion the third period is one of doubt whether *Ustulina* is as dangerous as was originally supposed. This was initiated by Small (1927), who stated that the diseases of rubber apparently caused by *Ustulina* actually are due to *Rhizoctonia*, and goes on to say that *Ustulina* is rarely directly responsible for serious disease of any plant. Though Small's opinions are to some extent supported by Britton-Jones (1927), they receive no support from the experiments of Weir (1929) and are directly opposed by Gadd (1929); there is, however, recent evidence which tends to show that *Ustulina* is not a primary infection (Sharples & Sanderson, 1932) or that attacks by *Ustulina* are usually associated with infection by some other fungus (Sharples, 1932). This latter point had been noted by other workers, *e.g.* Butler (1918), Ashplant (1925), etc., and, though investigation is needed, it seems probable that this point of view most correctly represents the true state of affairs.

Literature on *Ustulina* is not extensive, and it has been considered expedient to make the survey in the form of annotated references. The list is not guaranteed complete, only those references being given which I have had the opportunity of verifying. In view of the proposed scope of the present investigation all references have been included, whether in text or available exsiccati, which tend to illustrate points of taxonomy, geographical distribution or pathology.

For facilities in connection with the preparation of this list the writer is specially indebted to: Mr J. Ramsbottom, Keeper, Department of Botany, British Museum, and to his assistant Mr E. H. Ellis; Mr A. D. Cotton, Keeper, and Miss E. M. Wakefield, Mycologist, Herbarium, Royal Botanic Gardens, Kew; Dr E. J. Butler, Director, Imperial Mycological Institute, Kew, and his assistant Miss K. Secker for help with Dutch translation.

ANNOTATED LIST OF PREVIOUS REFERENCES

1729. Micheli, P. A. *Nova plantarum genera*, p. 104.
This is probably the first authentic reference to the fungus now known as *Ustulina*; it is described under the name "Lichen-agaricus crustaceus," and said to have been found growing in the Boboli Gardens (Florence) "ad emortuas Lauri-radices." There is a recognisable figure.
It is also probable that the species described by Ray in 1686 under the name *Fungus quercinus niger*, said to grow on oak, and the *Agaricus lignosus niger*, which is described by Ruppius in 1676 as growing at the base of decayed tree trunks, are both equivalent to the above.

1742. Haller, A. von. *Enumeratio methodica stirp. Helvet. indig.* p. 90.
Lichen-agaricus Mich. is said to be "nihil frequentius in dejectorum arborum truncis" in Switzerland.

1768. Haller, A. von. *Hist. stirp. indig. Helvet.* III, 122.
Referring to the fungus as *Sphaeria maxima convexa nigerrima* says that it is of frequent occurrence in Switzerland on dead tree trunks.

1778. Weber, G. H. *Spicilegium florae Goettingensis*, p. 286.
Sphaeria maxima is said to grow everywhere in the woods of Germany, on dead tree trunks, especially beech.

1778*a*. Hudson, G. *Flora anglica*, 2nd ed., I, 641.
A fungus which he names *Lycoperdon fraxineum* is said to be equivalent to *Lichen-agaricus* Mich. and *Sphaeria maxima* Hall. The habitat is given as "in putrescentibus fraxini truncis," but, although often quoted as a reference to *Ustulina*, the species described by Hudson was undoubtedly *Daldinia concentrica*.

1780. Wiggers, F. H. *Primitiae florae Holsatiae*, p. 84, No. 939.
Largely a repetition of Weber; mentions *Sphaeria maxima* as occurring in Germany.

1785. Dickson, J. *Fasic. plantarum cryptog. Brit.* I, 23.
The first British record for *Sphaeria maxima* which is said to be found "in lignis putridis."

1785*a*. Latourette, M. A. L. C. de. *Chloris Lugdunensis*, p. 40.
The flora round Lyons includes *Sphaeria lycoperdoides* which is subdivided into (*a*) *fragilis*, (*b*) *confluens*, (*c*) *nigra* and (*d*) *maxima*, the last named being apparently identical with *S. maxima* Hall.

1787. Hoffmann, G. F. *Vegetabilia cryptogama*, 3, t. 1.
The species is named *Sphaeria deusta*, described briefly and said to grow in Germany on rotten trunks and branches.

1790. Tode, H. J. *Fungi Mechlenburgenses selecti*, II, 55.
This is the first reasonably full and accurate account of the species; it is named *Sphaeria versipellis* and is said to be found in Germany growing on dead trunks of beech.

1791. Bolton, J. *An appendix or supplement to Hist. of Fungusses growing about Halifax*, p. 181.
Sphaeria maxima is described as growing on old stumps of wood when far advanced in decay; his specimen was found on ash.

1791*a*. Bulliard, P. *Hist. des champignons de France*, I, 176; II, t. 487, f. 1.
Names the species *Hypoxylon ustulatum* and says that it is to be found in France forming large patches on old stumps.

1796. Persoon, C. E. *Observationes mycologicae*, I, 19, No. 37.

1801. Persoon, C. E. *Synopsis methodica fungorum*, p. 16.
Sphaeria deusta is briefly described and recorded from Germany as comparatively frequent on decayed trunks. He mentions also the variety *S. platyceps*.

1801*a*. Schumacher, C. F. *Enumeratio plantarum*, p. 163.
Sphaeria deusta grows on decayed roots in a variety of woods in Denmark.

1802. Relhan, R. *Flora cantabrigiensis*, ed. 2, p. 539, No. 1299.
Reports *Sphaeria maxima* as growing on rotten wood in the vicinity of Cambridge. He also mentions *S. fraxinea* which, he says, is the equivalent of Hudson's *Lycoperdon fraxineum* (*i.e. Daldinia*).

1803. Sowerby, J. *English fungi*, III, t. 338.
Gives coloured sketches of young (? conidial) and of old fructifications.

1804. Balbis, G. B. "Miscellanea botanica." *Mém. de l'Acad. des Sci. de Turin*, XII, 369.
Reports *Hypoxylon ustulatum* as growing on old tree trunks in Italy.

1805. Albertini, I. B. & Schweinitz, L. D. de. *Conspectus fungorum*, p. 6, No. 20.
Describe two varieties of *Sphaeria deusta* from Germany: (α) *sessilis*, frequent everywhere on trunks of deciduous trees; (β) *platyceps*, comparatively rare.
They describe also a new species, *S. tubulina*, which is said to grow on very rotten trunks of silver fir and which has once been found growing on alder (see Schröter, 1908).

1805*a*. Cummino, U. "Fungorum vallis Pisii spec." *Mém. de l'Acad. Imp. Sci. Turin*, XIV, p. 202.
Hypoxylon ustulatum occurs frequently on old or dead beech trees in the vicinity of Pisa.

1805*b*. Lamarck, J. & Candolle, A. P. de. *Flore française*, II, 285, No. 759.
Include *Sphaeria deusta* which is said to form "larges plaques sur les vieilles souches."

1808. Biroli, J. *Flora aconiensis*, II, 242.
Hypoxylon ustulatum is said to grow on tree trunks in Italy.

1812. Wahlenberg, G. *Flora lapponica*, p. 518.
Reports *Sphaeria deusta* as growing "in ligno betulino denudato" in Norwegian Lapland. (I have examined Wahlenberg's specimen in Herb. Mus. Brit. however, and it appears not to be *Ustulina*.)

1816. Nees, von E. Das *System der Pilze und Schwämme*, p. 295, t. 41, f. 316.
Gives a coloured, but very unconvincing, illustration of the fungus and states that in Germany it is "an alten Stammen häufig."

1817. Martius, C. F. P. von. *Flora cryptogamic Erlangensis*, p. 479.
A short description of *Sphaeria deusta* which is said to grow in Germany on trunks of beech, oak and willow.

1821. Nocca, O. & Balbis, G. B. *Flora ticinensis*, II, 297.
Sphaeria deusta is found frequently on rotten wood in Italy.

1821*a*. Hooker, W. J. *Flora Scotica*, II, 5.
Sphaeria deusta grows on trunks near Kinross.

1822. Schweinitz, L. D. de. "Synop. fungorum Carolinae super." *Comm. Soc. Nat. Cur. Lipsiensis*, I, 30.
The above species is said to be frequent in North Carolina.

1823. Fries, E. *Systema mycologicum*, II, 345.
Describes the species and states that it is common everywhere in Scandinavia on old and rotten trunks especially beech. In a set of specimens "Scleromyceti Sueciae" No. 261 is *Sphaeria deusta*. (Herb. Mus. Brit.)

1823*a*. Schmidt, I. C. "Versuch einer Eintheilung der Kugelpilze (Sphaeriae Pers.)." *Mycologische Hefte*, II, 25.
Reports *Sphaeria deusta* from Germany; his specimens in Herb. Mus. Brit. give the habitat as "on rotten trunks."

1824. Schlechtendal, D. F. L. de. *Flora Berolinensis*, II, 226.
Reports the species as growing on rotten trunks of beech and hornbeam in Italy.

1824*a*. Greville, R. K. *Flora Edinensis*, p. 355.
Names the species *Stromatosphaeria deusta* and says it is found round Edinburgh but is not frequent.

1825. Savi, C. *Botanicum Etruscum*, IV, 252.
Sphaeria deusta is reported from Italy where it is found on rotten trunks of beech, oak and chestnut.

1826. Re, F. *Flora Torinese*, II, 257.
Sphaeria deusta is found on a variety of woods in Italy.

1828. Greville, R. K. *Scottish cryptogamic flora*, VI, 324.
The species is described, with coloured pictures and diagrams, under the name *Hypoxylon deustum*. It is said to be frequent on stumps and trunks of trees in spring and autumn.

1830. Withering, W. *An arrangement of British plants*, 7th ed. IV, 361.
In each of the last six editions of this work, Withering mentions *Sphaeria maxima* and states that it grows on rotten wood and decayed roots.
He says that *S. fraxinea* Hall. No. 2192 is identical with *Lycoperdon fraxineum* Huds. and with *Sphaeria concentrica* Bolt. and that it differs from *S. maxima* in being more woody and showing concentric circles (*i.e.* it is *Daldinia*). There is some confusion here, as Haller's No. 2192 is *Sphaeria maxima* whereas there is no mention of *S. fraxinea*.

1832. Cristofori, J. de & Jan G. *Catalogus in IV sectiones div. rer. nat. in Museo exstantium*. Sect. I. 1. Enumeratio methodica plantarum exsicc. 20.
No. 10 is *Sphaeria deusta*.

1833. Wallroth, F. G. *Flora Germanica*, IV, 852, No. 4095.
States that *Sphaeria deusta* is found at the base of old tree trunks in Germany.

1834. Schweinitz, L. D. de. "Synopsis of North American fungi." *Trans. Amer. Phil. Soc.* N.S. IV, 193, No. 1215.
Sphaeria deusta grows in the states of Carolina, Pennsylvania and New York on roots and branches of trees.

1835. Kickx, J. *Flore crypt. des environs de Louvain*, p. 115, No. 308.
Hypoxylon ustulatum is said to be rare in Belgium but is occasionally found in hollows of rotten willows and on dead branches of other trees.

1836. Hooker, W. J. *Smith's English flora*, v, 240.
Sphaeria deusta is found in England on rotten tree trunks.

1837. Tommasini, M. & Biasoletto, B. "Streifzug von Triest nach Istrien im Frühling 1833." *Linnaea*, xi, 476.
Includes the species in a list from the above region of Austria.

1837*a*. Colla, L. *Herbarium Pedemontanum*, vii, 227.
Sphaeria deusta is reported from Italy on dead trunks of beech.

1838. Timm, I. C. *Florae megapolitanae prodromus*, p. 279.
Sphaeria maxima is said to grow on dead trunks of beech in North Germany.

1840. Montagne, J. F. C. "Seconde Cent. de plantes cellulaires exotiques nouvelles crypt. Guianensium." *Ann. Sci. Nat. Bot.* Sér. 2, xiii, 351.
Describing species received from M. Leprieur in Cayenne names one *Hypoxylon macrospermum* n.sp. It is said to grow on rotten wood in Guiana.

1843. Mougeot, J. B., Nestler, C. & Schimper, W. P. *Stirpibus crypt. Vosges-Rhenanis*, iii, 22, No. 276.
In a list of specimens from the above district *Sphaeria deusta* is said to grow "ad truncos putridos" (Herb. Mus. Brit.).

1845. Léveillé, J. H. "Crypt. exotiques." *Ann. Sci. Nat. Bot.* Sér. 3, iii, 48.
Mentions *Sphaeria deusta* as growing on trunks in Java. Describes also a new species which he calls *S. zonata*, closely related to the former but "elle s'en distingue facilement parce qu'elle est d'une couleur rousse et que sa surface est marquée de zones concentriques, caractère qui n'a encore été indiqué dans aucune espèce." It is found on palms. This is the first reference to the so-called tropical species of *Ustulina*.

1846. Dozy, F. & Molkenboer, J. H. "Flora crypt. van Nederland." *Ned. Kruid. Archief.* i, 52.
Sphaeria deusta is found in the Netherlands growing on willow trunks.

1846*a*. Fries, E. *Summa vegetabilium Scandinaviae*, p. 383.
Again refers, with no additional details, to *Hypoxylon ustulatum* growing in Scandinavia. Also mentions *H. tubulina* A. & S.

1850. Rabenhorst, L. "Vorläufiger botanischer Bericht über meine Reise durch die östlichen u. südlichen Provinzen Italiens." *Flora*, xxxiii, 374.
Sphaeria deusta is reported from Italy as growing on an orange tree.

1850*a*. Gay, C. *Historia Chili Botanica*, vii, 439.
Describes *Hypoxylon ustulatum* and states that it is found in Chili on trunks of *Citharexylon cyanocarpon*.

1856. Montagne, J. F. C. *Sylloge gen. spec. cryptogamarum*, p. 212, No. 724.
Refers again to *Hypoxylon macrospermum* growing on rotten wood in Guiana.

1858. Montagne, J. F. C. "Plantes cellulaires nouvelles." *Ann. Sci. Nat. Bot.* Sér. 4, ix, 55 (Sphaeriae Wallrothianae).
After the death of Wallroth, Montagne attempted more definitely to determine the Sphaeriae of the Flora Germanica. He mentions *Hypoxylon tuberiforme* (Wallr. MSS. sub. *Sphaeria*), which is described as "subterranean and about as large as a walnut." This species is not mentioned in the Fl. Germ. (the nearest being *Sphaeria tubaeformis* which is said to grow on fallen leaves of alder, etc.); later, however, Cooke (1883) puts *Hypoxylon tuberiforme* into the genus *Ustulina* and Saccardo (1891) confirms this allotment.

1859. Currey, F. *Trans. Linn. Soc. Lond.* xxii, 268, t. 46, f. 57.
Includes *Sphaeria deusta* in a list of the Sphaeriae of the Hooker Herbarium.

1860. Berkeley, M. J. *Outlines of British fungology*, p. 385, t. 24, f. 3.
Hypoxylon ustulatum is said to be common on rotten tree trunks in England.

1863. Cesati, V. & Notaris, G. de. "Schema di classif. degli Sferiacei italici aschigivi." *Comm. Soc. Critt. Ital.* I, 198.
States that *Hypoxylon ustulatum* is to be found in Italy, and Cesati (1860) in *Erbar. crittogam. Ital.* shows a specimen (No. 645) of the species which is said to be found on decayed trunks of poplar in Italy.

1863*a*. Tulasne, L. R. & C. *Selecta fungorum carpologia*, II, 23. (Eng. trans. Grove, 1930, II, 21.)
Gives the first really full account of the species with description of mycelium and fructification as well as measurements of conidia and spores. It is said to be "frequent throughout the whole year (in France) on the decorticated and carious wood of our native trees especially beech, elm and hornbeam." They name the fungus *Ustulina vulgaris*. The removal from the genus *Hypoxylon* and the establishment of the new genus *Ustulina* is explained by the statement "*Ustulina* displays almost all the characters by which true Hypoxylons are distinguished, but it is, we think, truly different in the structure of the conidiophorous hymenium, in which it resembles rather the Xylariae."

1866. Westendorp, G. D. *Prodromus florae Batavae*, II, iv, 44.
Sphaeria deusta (No. 3005) is found on dead willow trunks in Holland.

1867. Kickx, J. *Flore cryptogamique des Flandres*, I, 306.
Repeats that *Hypoxylon ustulatum* is rare in Belgium but is found on willow and old rotten stumps of beech.

1867*a*. Nitschke, T. *Pyrenomycetes Germanici, Die Kernpilze Deutschlands*, p. 21.
Agrees with Tulasne in the separation from *Hypoxylon* and states that *Ustulina vulgaris* is abundant in Germany on various deciduous trees especially beech and hornbeam.

1867*b*. Passerini, G. "Primo elenco di funghi Parmensi." *Comm. Soc. Critt. Ital.* II, 468.
Hypoxylon ustulatum is said to grow in Italy on oak.

1869. Fuckel, L. *Symbolae mycologicae*, p. 235.
States that *Ustulina vulgaris* grows on fallen stems of beech in Germany. In a set of specimens *Fungi Rhenani exsicc.* No. 1063 is *Ustulina* which is said to be frequent on rotten trunks of beech (Herb. Mus. Brit. and Herb. Kew.).

1870. Roumeguère, C. *Cryptogamie illustrée*, f. 319.
Gives a very poor illustration of *Sphaeria deusta*; but later (1879) in *Fungi selecti Galli exsiccati*, specimen No. 73 is named *Ustulina vulgaris* (Herb. Mus. Brit. and Herb. Kew.).

1870*a*. Amo y Mora, M. del. *Flora cryptogamica de la península Ibérica*, p. 595.
Describes *Ustulina* briefly and says that it grows in Spain and Portugal "ad truncos vetustos in sylvis frequens."

1871. Hohenbuhul-Heufler, L. J. von. *Enumeratio crypt. Italiae venetae*, p. 72.
Includes *Ustulina vulgaris* in this list of the cryptogams of Italy.

1871*a*. Cooke, M. C. *Handbook of British fungi*, p. 792.
Ustulina vulgaris is said to be common in England on rotten tree trunks. In *Fungi Britannici exsiccati*, 2nd ed., No. 465, is a specimen of *Ustulina* with diagram of spores (Herb. Mus. Brit. and Herb. Kew.).

1872. Thümen, F. von. *Fungi Austriaci exsiccati.*
Specimen No. 665 is *Ustulina vulgaris* from Bohemia; found growing on rotten trunks of beech (Herb. Mus. Brit. and Herb. Kew.).

1873. Saccardo, P. A. "Mycologiae Venetae specimen 153." *Atti Soc. Venet.-Trent. Sci. Nat.* II, 58.
The species grows in Italy on various trees, especially beech, but is said to be "non frequens." Notes on a specimen in *Mycotheca Veneta*, 1874, No. 255, state that it is "abundant on decayed beech trunks" (Herb. Mus. Brit. and Herb. Kew.).

1873*a*. Plowright, C. B. *Sphaeriacei Britannici*, Cent. I, No. 15.
Reports *Ustulina vulgaris* on roots of beech in England.

1875. Kunze, J. *Fungi selecti exsiccati.*
Specimen No. 154 (Herb. Mus. Brit. and Herb. Kew.) is *Ustulina vulgaris*, which is said to grow on beech and hornbeam in North Saxony.

1876. Berkeley, M. J. "Notices of North American fungi." *Grevillea*, IV, 94.
Includes *Hypoxylon ustulatum* in this list of fungi from North America.

1877. Bucknall, C. "The fungi of the Bristol district." *Proc. Bristol Nat. Soc.* II, 217.
Reports *Ustulina* as growing in the above district.

1878. Fabre, J. H. "Essai sur les Sphaeriacées du dept. de Vaucluse." *Ann. Sci. Nat.* Sér. 6, IX, 82.
States that *Ustulina vulgaris* grows at the base of old beech trees in this district.

1879. Cesati, V. "Mycetum in itinere Borneensi lectorum." *Atti della R. Accad. Napoli*, VIII, 18.
Hypoxylon ustulatum is said to grow in Ceylon and Sarawak. Cesati also describes a new species from Sarawak which he calls *H. pavimentosum.*

1879*a*. Berkeley, M. J. (Herb. Kew.)
In the Berkeley herbarium at Kew are specimens of *Ustulina vulgaris* from Cuba, Venezuela, Guinea, Juan Fernandez, Cayenne, Java (on dead bamboo), Ceylon, Carolina and New Hampshire, also a specimen of *Hypoxylon tessulatum* n.sp. from Bombay.

1880. Lambotte, D. M. E. *Flore mycologique Belge*, II, 425.
Gives short notes on the genus and species which, he says, grows in Belgium on old, rotten trunks.

1881. Spegazzini, C. *Fungi Argentini*, IV, 50, No. 136. *Anal. Soc. Cientif. Argentina*, XII.
Mentions a new species, *Ustulina brasiliensis*, which grows on rotten trunks in the Argentine and Brazil; he gives the measurements of asci and spores but no other details.

1882. Penzig, O. *Funghi agrumicoli*, p. 25.
Gives a short but fairly detailed description of *Ustulina vulgaris* which, in Italy, is found growing parasitically at the base of *Citrus aurantium.* No. 1143 gives coloured sketches of the fructification, asci and spores with measurements.
The account is repeated in *Michelia*, 1882, II, 409, and the sketches are reproduced in Saccardo's *Fungi italici autographice delineati*, 1882, No. 1143.

1882*a*. Saccardo, P. A. *Sylloge fungorum*, I, 350.
Four species of *Ustulina* are recognised: (1) *U. vulgaris* Tul. with list of synonyms; (2) *U. brasiliensis* Speg.; (3) *U. macrosperma* (Mont.) Sacc. = *Hypoxylon* Mont.; (4) *U. zonata* (Lév.) Sacc. = *Sphaeria* Lév.
Sphaeria tubulina A. & S. is put into a new genus *Bolinia* (p. 352). Later, however, Schröter (1908) puts this back into *Ustulina* and says it is synonymous with *U. maxima* (*i.e. U. vulgaris*); finally Miller (1932) transfers it to *Nummularia* as *N. tubulina.*

1882*b*. Linhart, G. *Fungi Hungarici exsiccati* (Herb. Mus. Brit.).
Shows specimen No. 182, *Ustulina vulgaris* on oak and gives sketches of conidial and perithecial fructifications.

1883. Cooke, M. C. "*Nummularia* and its allies." *Grevillea*, XII, 3.
Comments on the genus *Ustulina.* Agrees to the four species mentioned by Saccardo above and suggests addition of the following three: (1) *U. tessulata* (Berk.) Cke = *Hypoxylon tessulatum* Berk. (which has not previously been described); (2) *U. pavimentosa* (Ces.) Cke = *Hypoxylon* Ces.; (3) *U. tuberiformis* (Wallr.) Cke = *Sphaeria* Wallr. (though he has "seen no authentic specimen"). He says that it is possible that *Sphaeria teres* (Schw.) might be an *Ustulina*, but preferably should remain in *Hypoxylon.*

1884. Oudemans, C. A. J. A. *Revisio pyrenomycetum*, p. 32.
Ustulina vulgaris is said to be found on trunks of beech and willow, in Holland.

1884*a*. Bommer, E. & Rousseau, M. *Florule mycologique des environs de Bruxelles*, p. 172.
Mentions species as growing near Brussels.

1884*b*. Spegazzini, C. "Fungi Guarantici." *Ann. della Cient. Argentina*, xviii, 268.
Describes a new species *Ustulina microspora* Speg. growing on rotten trunks in the woods of Guiana. (A specimen from Paraguay collected by Balansa in 1883 was labelled *U. microspora* Speg. by Cooke in 1885. It is described as growing on dead wood (Herb. Kew.).)

1885. Saccardo, P. A. & Berlese, A. N. "Catalogo dei funghi Italiani." *Atti Soc. Critt. Ital.* iii, 308.
Include *Ustulina vulgaris* in this list.

1885*a*. Wettstein, R. von. "Vorarbeiten zu einer Pilzflora der Steiermark." *Verhandlungen der K.K. zool.-bot. Gesellsch. Wien*, xxxv, 592.
Renames the species *Ustulina maxima* and says that it grows abundantly in certain parts of Austria at the base of dead beech trunks.

1885*b*. Bizzozero, G. *Flora veneta crittog. I. Fungi*, p. 199.
Gives a brief description with statement that in the region of Venice the species grows on beech and, more rarely, on lime and hornbeam.

1886. Broome, C. E. (Herb. Mus. Brit.)
Shows a specimen of the conidial stage of *Ustulina vulgaris* on beech, from Burnham Beeches (England).

1887. Winter, G. "Pilze." Rabenh. *Krypt. Fl.* i, ii, 869, and fig. on p. 844.
Gives a more or less detailed account of the fungus with measurements of spores, etc., but no reference to habitat other than "on old stumps of deciduous trees."

1887*a*. Penzig, O. "Studi botanici sugli Agrumi." *Ann. di Agric.* p. 330, No. 116.
In this treatise on *Citrus*, *Ustulina vulgaris* is again said to be parasitic on old trees in Italy.

1888. Farlow, W. G. & Seymour, A. B. *A provisional host index of the fungi of the U.S.A.* Part ii, p. 123.
Ustulina is mentioned only as growing on *Quercus virens*.

1889. Richon, C. *Catalogue des champignons qui croisent dans le Dept. de la Marne*, pp. 262 and 537.
Ustulina vulgaris grows in the above district on dead trunks of maple, poplar, etc. Gives a diagrammatic sketch of spores.

1889*a*. Palmer, E. (Herb. Mus. Brit.)
Shows a specimen of *Ustulina* from Guadalupe Island (Mexico).

1889*b*. Spegazzini, C. "Fungi puiggariani." *Boletin Acad. Nac. Cien. en Cordova*, xi, 517.
Two species of *Ustulina* are said to grow in Brazil. No. 271 is *U. brasiliensis* Speg. growing on rotten trunks, and No. 272 is *U. vulgaris* on rotten branches in woods.

1890. Zopf, W. "Die Pilze." Schenk's *Hbk. d. Bot.* iv, 733, f. on p. 320.
Gives a brief note, with diagrams, of *Ustulina* which is said to be "an Baumstumpfen sehr häufig," in Germany.

1890*a*. Sydow, P. *Mycotheca marchica* (Herb. Mus. Brit.).
Sent out specimens from Germany as follows: *Ustulina vulgaris*, No. 863 (1885) on beech; No. 1549 (1887) on birch; No. 1653 (1887) on lime; No. 2556 (1889), conidial stage, on maple. Also a specimen of a species which was afterwards called *U. linearis* (see Rehm, 1892), No. 2959 (1890) on silver birch.

1891. Saccardo, P. A. *Sylloge fungorum*, ix, 542.
Adds *Ustulina tessulata* (Berk.) Cke and *U. microspora* Speg. (see Add. ad i–iv, 49) and also admits "ad genus *Ustulinam* pertinent," sec. Cooke, the species *Hypoxylon pavimentosum* Ces. and *H. tuberiforme* (Wallr.) (see Add. ad i–iv, xxx).

1892. Cooke, M. C. *Handbook of Australian fungi*, p. 290, f. 200.
Describes *Ustulina vulgaris* as growing on branches in Queensland.

1892*a*. Ellis, J. B. & Everhart, B. M. *North American Pyrenomycetes*, p. 662, t. 39, figs. 5 and 8.
Ustulina vulgaris is found on decaying stumps in North America. *Fungi Columbiani*, specimen No. 1997 (dated 1904) appears to be *Ustulina* on rotten oak wood from California (Philadelphia).

1892*b*. Berlese, A. N. & Peglion, N. "Micromiceti toscani." *Nuovo Giorn. Bot. Ital.* xxiv, 117.
The species is reported from Italy as growing on old and decayed trunks of beech.

1892*c*. Rehm, H. In Karsten's "Fragmenta mycologia." *Hedwigia*, xxxi, 310.
Gives the name *Ustulina linearis* Rehm to a new species on silver birch which had been received from Sydow in 1889. He also distributed specimens from Germany; No. 1089 (1889) is *U. linearis*, and No. 2022 (1912) is *U. maxima* (Web.) Wettst. from fallen beech trunks near Munich (see *Ann. Mycol.* 1912, x, 540).

1892*d*. Elliot, W. R. (Herb. Mus. Brit.)
Nos. 263 and 1276 are specimens of *Ustulina vulgaris* from Dominica, West Indies.

1895. McAlpine, D. *Syst. arrangement of Australian fungi*, p. 116.
Finds *Ustulina* in Queensland on branches and logs.

1895*a*. Saccardo, P. A. *Sylloge fungorum*, xi, 285.
Adds the above new species *Ustulina linearis* Rehm to the genus *Ustulina*.

1895*b*. Jaczewski, M. A. de. *Les Xylariées de la Suisse*, p. 112.
Describes the perithecial and conidial stages of the fungus and gives list of synonyms and herbarium specimens. He states that *Ustulina* is found in Switzerland "sur les vieux troncs pourris de *Fagus*, plus rarement sur les autres arbres."

1896. Wehmer, C. "Pilzkrankheiten land- und forstwirtschaftlicher Kulturgewächse in Hannoverschen während des Sommers 1896." *Cent. Bakt.* Abt. ii, ii, 796.
States that it is uncertain to what extent the widespread *Ustulina vulgaris* at the base of living and apparently healthy beeches, limes, etc., is injurious.

1897. Penzig, O. & Saccardo, P. A. "Diagnoses fungorum novorum in insula Java collectorum. Ser. ii." *Malpighia*, xi, 493.
Ustulina is said to grow in Java "cortibus putricentibus varies."

1897*a*. Oudemans, C. A. J. A. *Révis. des champignons dans les Pays Bas*, ii, 177.
States that in the Netherlands the species is of widespread occurrence (cf. Kickx, 1835, 1867) on trunks and roots in a state of decay but is specially prevalent on beech.

1897*b*. Bresadola, G. & Saccardo, P. A. "Enumerat. dei funghi della Valsesia." *Malpighia*, xi, 293.
Ustulina vulgaris is found on beech trunks in Italy.

1897*c*. Lindau, G. In Engler & Prantl's *Pflanzenfamilien*, p. 482, f. on p. 483.
Mentions four species: *Ustulina vulgaris* Tul.; *U. brasiliensis* Speg.; *U. zonata* (Lév.) Sacc.; and *U. tessulata* (Berk.) Cke; gives descriptions and diagrams and the parts of the world in which the species were originally found.

1897*d*. Saccardo, D. *Mycotheca italica* (Herb. Mus. Brit.).
Shows two specimens of *Ustulina vulgaris* from trunks of *Celtis australis* in Italy. No. 78 is perithecial and No. 285 is the conidial fructification.

1898. Wildemann, E. & Durand, Th. *Prodrome de la Flore Belge* (1898–1907), I.
The species is said to be found in several parts of Belgium but no hosts are mentioned.

1900. Hennings, P. "Fungi. II." *Monsunia*, p. 169.
Reports *Ustulina vulgaris* on rotten wood in the virgin forests of Java. He mentions also *Hypoxylon gigaspermum* n.sp. but, except that both are included under the general heading of Xylariaceae, no connection is indicated between this and *Ustulina* (see von Höhnel, 1909).

1900*a*. Saccardo, P. A. & Cavara, V. "Funghi de Vallambrosa." *Nuovo Giorn. Bot. Ital.* VII, 285.
Ustulina vulgaris is said to have been found in Italy growing on *Abies pectinata*—the only record so far for a coniferous host.

1901. Maire, R., Dumée, P. & Lutz, L. "Prodrome d'une flore mycol. de la Corse." *Bull. Soc. Bot. Fr.* Sér. iv, p. 184.
Give lists of fungi from different types of habitat in Corsica; *Ustulina* is included in the list from beech woods but is not included as growing in "les forêts de Pins," "les forêts de Sapins," or any other formation.

1902. Patouillard, N. *Bull. Soc. Mycol. Fr.* XVIII, 186.
Describes what appears to be the conidial stage of *Ustulina* as a new, parasitic species, *Stilbum Ustulinae*, which is said to be "assez commune sur les vieux stromes d'*Ustulina*," in Martinique.

1904. Saccardo, P. A. "Reliquie dell' erbario micologico di P. A. Micheli." *Bull. Soc. Bot. Ital.* p. 225.
Merely notes that *Ustulina maxima* (Web.) Schröt. & *U. vulgaris* Tul. are the new names for Micheli's *Lichen-agaricus*.

1905. Massee, G. & Crossland, C. *Fungus flora of Yorkshire*, p. 217.
Record the species from several parts of Yorkshire as growing on oak trees and on stumps of ash.

1906. Traverso, J. B. *Flora italica cryptogama. I. Fungi—Pyrenomycetae*, II, 36.
Agrees with Wettstein in calling the species *Ustulina maxima*. States that it grows all over Italy and Corsica, generally on beech and, more rarely, on hornbeam, *Celtis*, *Citrus*, chestnut and oak. He also describes a new species *Ustulina microspora* distinguished from *U. vulgaris* chiefly in that it has smaller spores. This species is found on oak.

1907. Petch, T. "Root diseases of tea." *Trop. Agric.* XXVIII, 293.
The cause of "low-country root disease" of tea is said to be an undescribed species of *Ustulina* subsequently identified with *U. zonata* (Lév.) Sacc. Though previously known as a cause of root disease in the tropics this is the first record of *Ustulina* as a parasite of economic importance. Specimens from Petch were exhibited by Plowright at a meeting of the Science Committee of the R.H.S. (*Gard. Chron.* XLII, 362) and shown closely to resemble specimens from beech in this country. Petch suggests that the species must in future be regarded as a parasite on beech.

1908. Schröter, J. "Die Pilze Schlesiens." *Cohn's Kryptogamen-Flora von Schlesien*, III, 465.
Gives brief description with measurements of spores, etc. Mentions two species of *Ustulina* from south-east Germany: (1) *U. maxima* which is found at the base of tree stumps, especially beech; and (2) *U. tubulina* (=*Hypoxylon tubulina* Fr.), probably identical with *U. maxima*, described as growing on the stems of old coniferous trees (*e.g. Picea alba*).

1908*a*. Theissen, F. von. "Novitates riograndenses." *Ann. Mycol.* vi, 347.
Describes a new species, *Ustulina pyrenocrata*, from Brazil. He compares this with *U. macrosperma* (Mont.) Sacc. and expresses the opinion that it falls naturally into the genus *Ustulina*. The habitat is given as "ad corticem crassum in silva."

1908*b*. Theissen, F. von. "Fragmenta brasilica (Rio Grande)." *Ann. Mycol.* vi, 533.
Records *Ustulina vulgaris* from Brazil and states that it is synonymous with *Nummularia macrosperma* Pat., *Ustulina brasiliensis* Speg. and *U. zonata* (Lév.) Sacc.

1909. Theissen, F. von. "Xylariaceae austro-brasiliensis." *Ann. Mycol.* vii, 10.
Again mentions *Ustulina vulgaris* and adds *U. pyrenocrata* to the list of synonyms.

1909*a*. Höhnel, F. von. "Fragmente zur Mycologie. VI." *Sitz. K. Akad. Wiss. Wien. Mathem. Naturw. Kl.* Abt. i, cxviii, 69.
Refers to *Ustulina zonata* growing on palms in Java. He mentions also *Hypoxylon gigaspermum* Henn. which he identifies with *H. macrospermum* Mont. and suggests that both belong to the genus *Ustulina*. (The latter had already been included in this genus by Saccardo, *Syl. Fung.* i, 350.)

1910. Petch, T. "Root diseases of tea." *Circ. Roy. Bot. Gard. Ceylon*, v, 107.
Repeats that *Ustulina zonata* is the cause of a serious root disease of tea in Ceylon; it spreads to the tea from stumps of *Grevillea* and *Albizzia* on which it has been growing saprophytically.

1911. Delacroix, G. & Maublanc, A. *Maladies des plantes cultivées dans les Pays Chaudes*, p. 440.
Also note *Ustulina zonata* on tea and *Grevillea* in the tropics.

1911*a*. Petch, T. *The physiology and diseases of* Hevea brasiliensis, p. 159.
In discussing the diseases of rubber is uncertain as to whether *Ustulina* causes a disease of this plant.

1911*b*. Fénix, E. *Flora of Philippines.*
Shows a specimen of *Ustulina vulgaris* from the Philippine Islands (Herb. Mus. Brit. and Herb. Kew.).

1912. Petch, T. "Revisions of Ceylon fungi. Part III." *Ann. Roy. Bot. Gard. Peradeniya*, v, 286.
Gives a detailed account of *Ustulina zonata*. He disagrees with von Höhnel that the conidial stage of this species differs in any marked degree from that of *U. vulgaris* and expresses the opinion that the species are identical, the only important difference being the pathogenic status of the former. In Ceylon the fungus attacks the roots of tea, *Albizzia*, *Citrus*, *Cassia* and *Lafoensis*. Petch describes the appearance of the fungus in culture and emphasises the variability of the growth forms.

1913. Lind, J. *Danish fungi in Herb. E. Rostrup*, p. 252.
Reports *Ustulina deusta* from Denmark as growing very commonly on beech and being found also on poplar, sycamore, lime, elm, ash, hornbeam and horse-chestnut.

1913*a*. Saccardo, P. A. *Sylloge fungorum*, xxii, 334.
Recognises *Ustulina microsperma* Trav. (err. *U. microspora*); *U. pyrenocrata* Theiss., as "a typo generis nonnihil recedens"; and agrees to *U. maxima* (Web.) Wettst. as the correct name, by priority, for *U. vulgaris* Tul.

1913*b*. Petrak, F. *Flora Bohemiae et Moraviae exsiccata.*
Shows a specimen of *Ustulina maxima* from Podhorn (No. 161*b*) (Herb. Mus. Brit. and Herb. Kew.).

1914. Maublanc, A. "L'*Ustulina pyrenocrata* Theiss. type du genre nouveau *Theissenia*." *Bull. Soc. Mycol. Fr.* xxx, 49.
Received specimens from Brazil which were identical with Theissen's *Ustulina pyrenocrata* and suggests that the latter should be the type of a new genus *Theissenia*; *Theissenia pyrenocrata* (Theiss.) Maubl.

1914*a*. Petch, T. "The fungus diseases of *Hevea brasiliensis*." *Internat. Rubber Cong. Batavia.*

Ustulina zonata said to be common cause of root disease in Ceylon attacking tea, *Cassia nodosa, Berrya ammomilla, Casuarina montana, Melia dubia, Lafoensis vandelliana, Derris robusta* and *Citrus decumana. Hevea* is not normally attacked but may be infected when planted among tea.

1914*b*. Rehm, H. *Ascomycetes Philippinenses*, v, 2207.

Describes two species from the Philippines: (1) *Ustulina placentiformis* growing on dead wood; and (2) *U. placentiformis* var. *magnifica* growing on rotten trunks.

1914*c*. Brooks, F. T. "A new disease of plantation rubber in Malaya." *Agric. Bull. Federated Malay States*, III, 105.

Definitely asserts that *Ustulina zonata* is pathogenic on *Hevea* in Malaya. Having described the fructifications he quotes inoculation experiments in which the fungus was put into contact with eight wounded and six unwounded trees; after seven weeks all the first eight were infected, three being killed, while of the unwounded trees only one showed any sign of infection.

1915. Brooks, F. T. "A disease of plantation rubber caused by *Ustulina zonata*." *New Phytol.* XIV, 152.

An amplification of the previous paper describing the appearance of the fungus and effect on tissues of *Hevea.* Infection is in collar region and then spreads more rapidly in a longitudinal than in a radial direction. Inoculation of three wounded and three unwounded seedling rubber plants gave the inconclusive result that two of the wounded and one of the unwounded became infected.

1915*a*. Maitland, T. D. (Herb. Mus. Brit. and Herb. Kew.)

Specimen No. 306 labelled *Ustulina vulgaris* is from dead stump of *Phoenix reclinata* in Uganda; while specimen No. 192, from the same district with no details, is labelled *Ustulina zonata.*

1915*b*. Farlow, W. G. *Reliquiae Farlowianae—Fungi.*

Specimen No. 89 is said to be *Ustulina vulgaris* from dead wood of *Acer rubrum* in New Hampshire, U.S.A. (Herb. Mus. Brit. and Herb. Kew.).

1916. Sharples, A. "*Ustulina zonata* on *Hevea brasiliensis*." *Agric. Bull. Federated Malay States*, IV, 98.

A preliminary note stating that inoculation experiments in Malaya tend to show that *Ustulina* is a wound parasite attacking lateral roots of *Hevea.*

1916*a*. Sharples, A. "*Ustulina zonata*, a fungus affecting *H. brasiliensis*." *Dept. Agric. Federated Malay States Bull.* No. 25.

A fairly detailed paper stating that *Ustulina* is definitely a cause of disease of rubber. Attention is called to the fact that infection is intimately connected with attacks of boring beetles. The Malayan species is said to agree in every respect with the Ceylon species described by Petch. He describes cultural experiments and the effect of the fungus on the tissues of the host, and says, "as the fungus advances the wood is stained a brown colour," this brown wood is said to be permeated with hyphae which are mostly confined to the rays; later, however, the wood becomes crumbly and traversed by the "black lines." Inoculation experiments on seedlings and on five-year-old trees both gave positive results. In the second, more conclusive experiment, twelve roots and six branches were inoculated with the result that seven of the roots and all the branches became infected. The control was negative.

1916*b*. Sharples, A. "Scorched trees and their treatment." *Agric. Bull. Federated Malay States*, V, 1, also in *Trop. Agric.* 1917, XLVIII, 56.

Scorched trees are subject to attacks of boring beetles followed by infection of *Ustulina.*

1916*c*. Petch, T. "Diseases of *Hevea*." *Trop. Agric.* xlvii, 275.
In addition to tea, *Ustulina* is said to be found on cacao and *Eugenia* where it gains entrance after an attack of canker or "pink disease," living saprophytically at first and parasitically later. It is also said to grow on *Pumelo*, *Halmilla* and *Lunumidella*.

1916*d*. Bryce, G. "Diseases of *Hevea brasiliensis*." *Bull. Dept. Agric. Ceylon*, No. 29, also in *Trop. Agric.* 1917, xlviii, 82.
Ustulina given as one of the commonest root diseases in Ceylon; infection may take place at wounds on root and stem or at unwounded branch forks. He gives list of hosts as given above under Petch.

1916*e*. Mitchell, J. "Diseases and pests." *The Times Trade Supplement*, 4th December, p. 16.
In the disease section of this survey of the rubber industry from an Imperial standpoint, Mitchell states that root disease caused by *Ustulina* may prove to be of serious importance. Infection is near the collar, passing into the main and lateral roots. Detection of this disease is possible only at a stage which is too late to save the tree from being killed.

1916*f*. Petrak, F. *Fungi Polonici exsiccati*.
No. 570 is a specimen of *Ustulina deusta* from Poland (Herb. Mus. Brit. and Herb. Kew.).

1917. Belgrave, W. N. C. "Root diseases of *Hevea* and clean-clearing." *Agric. Bull. Federated Malay States*, v, 320, also in *Proc. 1st Agric. Conf. Malaya*, 1917, p. 55.
Again reports *Ustulina* as a root disease of rubber in Malaya and says infection is by spores.

1917*a*. Wakefield, E. M. "Nigerian Fungi. III." *Kew Roy. Bot. Gard. Bull.* No. 105.
In description of collection of fungi by C. U. Farquharson, *Ustulina zonata* is said to be the cause of a disease of Para rubber in Nigeria. The specimens are in Herb. Kew.

1917*b*. Sharples, A. & Belgrave, W. N. C. "Mem. recom. clean-clearing of rubber estates in Malaya." *Agric. Bull. Federated Malay States*, vi, 89.
Ustulina causes rot of soft woods, *e.g.* rubber. Infection is by spores from fructifications on old stumps, therefore most important control measure is removal of all sources of spore production.

1917*c*. South, F. W. "Appl. of Agric. pests enactm." *Agric. Bull. Federated Malay States*, v, 349; also in *Proc. Agric. Conf. Malaya*, 1917, p. 86.
Fines imposed in Selangore for non-removal of logs, etc., due to emphasis by mycologists of the necessity for this precaution in prevention of disease by *Ustulina*.

1917*d*. Webster, P. J. "Rubber cult. in the Philippines." *Philippine Agric. Rev.* x, 219.
Ustulina occurs on rubber in these islands, but is not a serious pest.

1918. Butler, E. J. *Fungi and Disease in Plants*, p. 438.
The commonest cause of "stump rot" of tea in India and Ceylon is *Ustulina zonata*; originates from *Grevillea* stumps and passes from root to root in tea but is not known to pass through the soil nor to form mycelial strands. Found on dead *Hevea* in Ceylon and on living *Hevea* in Malaya. Usually on sandy soil and often associated in decay with *Rosellinia*. Gives list of hosts already mentioned.

1918*a*. Bernard, C. "De wortelkraagschimmel." *Meded. v. h. Proefst. voor thee*, lxi, 34.
Gives symptoms of disease, detailed description of the fungus, mode of infection and diagnostic method of identification. In the Dutch East Indies, old and wounded tea plants are affected as well as a large number of native trees including *Tephrosia candida*.

1918*b*. Bernard, C. "Over de door schimmels veroorzaakte wortelziekten der theeplant." *Meded. v. h. Proefst. voor thee*, LXI, 8, 31.
Ustulina found on roots of cacao in Java and Sumatra.

1918*c*. Palm, B. "De wortelziekten v. de theeplant." *Meded. v. h. Proefst. voor thee*, LXI, 23.
Infection of tea by *Ustulina* in the Dutch East Indies is through wounds, only old trees are attacked and control can be effected by application of tar.

1918*d*. Tanaka, T. "New Japanese fungi." *Mycologia*, X, 91.
Describes *Ustulina Mori* K. Haru n.sp. from the trunks of *Morus alba* in Japan. This is compared with *Ustulina microspora* from which it differs in the shape and dimensions of the spores.

1918*e*. Sharples, A. "*Ustulina zonata*, a fungus affecting *Hevea brasiliensis*." *Ann. Appl. Biol.* IV, 153.
Practically the same as 1916 paper. Disease of rubber by *Ustulina* is prevalent all over the Malay States; infection is via wounds and makes good progress in six months.

1918*f*. Swart, N. L. "Een en andes over *Hevea*-ziekten." *Ned.-Ind. Rubbertijdschrift*, p. 27.
Reports *Ustulina* on rubber from the Dutch East Indies.

1918*g*. Tunstall, A. C. "Tea rots. Part II." *Pamph. of Indian Tea Assoc.* p. 11.
Tea disease caused by *Ustulina* is one of the commonest in North-East India; more destructive on sandy than on clay soils. Undoubtedly the same species as that described for Ceylon by Petch and for Malaya by Sharples. Inoculation experiments by spores were not successful and root inoculation by mycelium produced infection but did not kill the plants.

1918*h*. Petrak, F. *Fungi Albanici et Bosniaci exsiccati.*
No. 165 is a specimen of *Ustulina vulgaris* from the above region.

1919. Bernard, C. "Aanvullende Mededeelingen over de wortelziekten van de thee." *Meded. v. h. Proefst. voor thee*, LXII, 1.
Gives a description of *Ustulina zonata* with photographs and coloured illustrations. Expresses the opinion that it usually grows in low-lying districts in Dutch East Indies.

1919*a*. Knowles, C. H. *Ann. Rept. of Agric. Fiji Is. Div. of Plant Pathol.* 1918, p. 19.
A hitherto unrecorded disease of plantation rubber was identified by Petch as being due to *Ustulina zonata*. The fungus has been found in these islands on mango, *Citrus* and *Hibiscus*.

1920. South, F. W. "Certain host plants of *Fomes lignosus* and *Ustulina zonata*." *Agric. Bull. Federated Malay States*, VIII, 243.
Ustulina zonata is found in the flat riverside districts on heavy clay soil in Jahore (Singapore) on stumps of "Pinang" Palm (*Areca catechu*).

1920*a*. Chipp, T. F. (Herb. Mus. Brit. and Herb. Kew.)
Two specimens: No. 6169 *Ustulina vulgaris* on *Canarium commune* from Singapore and another called *U. zonata* on dead *Eucalyptus* from Malaya.

1920*b*. Rutgers, A. A. L. "Ziekten van *Hevea brasiliensis* en hare bestrijding." *Overgedrukt nit h. handbock v. d. rubbercult. in Ned.-Ind.* p. 16.
Disease caused by *Ustulina*, though reported from Malacca, Sumatra and occasionally from Java, is not serious in the Dutch East Indies. It is distinguished from other similar diseases by the crumbly nature of the diseased wood. Control measures are costly and the results far from satisfactory.

1920*c*. Spegazzini, C. "Sobre algunas enfermedades y hongos que afectan las plantas de 'agrios' en el Paraguay." *Ann. Soc. Cient. Argentina*, XC, 172.
Gives a description, with measurements, of *Ustulina brachyspora* Speg. n.sp. and states that it has been found on orange (*Citrus aurantium* v. *amara*) in the district round Asuncion.

1920*d*. Petrak, F. *Mycotheca Carpatica.*
No. 148 is a specimen of *Ustulina vulgaris* from Czecho-Slovakia (Herb. Mus. Brit. and Herb. Kew.).

1921. Petrak, F. "Beiträge zur Pilzflora v. Mahren u. Österr-Schlesien." *Ann. Mycol.* XIX, 279.
The oldest authentic name of the fungus is *Sphaeria deusta* Hoffm., therefore it should be called *Ustulina deusta* (Hoffm.) Petr.

1921*a*. Van Hall, C. J. J. "Ziekten en plagen der cultuurgewassen in Ned.-Ind. 1920." *Meded. Inst. v. Plantenziekten*, XLVI (*Rev. Appl. Mycol.* 1922, I, 19).
Ustulina zonata is said to be found on rubber in the Dutch East Indies.

1921*b*. Van Hall, C. J. J. "Ziekten en plagen der cultuurgewassen in Ned.-Ind. 1921." *Meded. Inst. v. Plantenziekten*, LIII (*Rev. Appl. Mycol.* 1923, II, 9).
Ustulina causes root disease of tea in the Dutch East Indies particularly at high altitudes.

1921*c*. Petch, T. "Plant diseases and pests in Ceylon." *Trop. Agric.* LVII, 192 (*Rev. Appl. Mycol.* 1922, I, 160).
Merely includes *Ustulina* as causing rot in certain instances.

1921*d*. Petch, T. *Diseases and pests of the rubber tree*, p. 55 (*Rev. Appl. Mycol.* 1922, I, 135).
A fairly detailed account of the symptoms and effects of *Ustulina* on rubber. The disease is essentially a collar-rot and is most effective from ground level to a height of about two feet. Infection is said to be possible when the bark is intact and the wood not exposed. *Kretschmaria micropus* produces the same effect on the wood and only the fructifications distinguish the two fungi. Repeats previous list of hosts with the addition of ebony and *Scolopia*.

1921*e*. Bryce, G. "Rept. on work of Bot. and Mycol. Div." *Rept. Dept. Agric. Ceylon*, 1920, p. 13 (*Rev. Appl. Mycol.* 1922, I, 162).
States that attacks of *Ustulina* are due to non-removal of logs on which it has been growing saprophytically.

1921*f*. Snowdon, J. D. "Rept. Gov. Bot. 1920." *Ann. Rept. Dept. Agric. Uganda*, p. 43 (*Rev. Appl. Mycol.* 1922, I, 206).
Says that there is no authentic record of *Ustulina* causing disease of rubber, tea or cocoa in Uganda.

1921*g*. Lloyd, C. G. *Mycological writings*, VI, 977.
Note 908 states that the author had received a specimen of *Ustulina vulgaris* from J. Weir (Cuba) which differed very considerably from an American specimen in the author's possession. Note 1032, p. 1093, records receipt of a specimen from E. B. Stirling (New Jersey), while on p. 1066 is an account of a fungus named *Phyllocarbon Yasudai* (No. 633, Yasuda coll. Mt Kirishima, Japan) which Lloyd says is very like an *Ustulina*—the photograph (p. 2008) of this specimen is, however, very unconvincing.

1922. Jardine, N. K. & Reeves, A. T. (separately). *Rept. Act. Entomol. Ceylon, Adminis. Rept.* p. 21.
Reports *Ustulina zonata* on tea in central and on rubber in southern districts of Ceylon.

1922*a*. Eaton, B. J. *Rept. of Div. of Agric. Federated Malay States and Straits Settlements*, 1921 (*Rev. Appl. Mycol.* 1923, II, 396).
States that *Ustulina* is a cause of dry rot in the Malay States.

1922*b*. Macdonald, J. *Ann. Rept. Mycol. Div. Dept. Agric. Kenya*, 1921, p. 81 (*Rev. Appl. Mycol.* 1923, II, 260).
In Kenya, *Ustulina* frequently attacks roots of tea, coffee and rubber on old forest lands, and has also been found causing disease of pear and peach trees.

1922*c*. Petch, T. "Rept. Div. of Bot. and Mycol." *Ann. Rept. Ceylon Dept. Agric.* 1921, p. 21 (*Rev. Appl. Mycol.* 1923, II, 7).
Ustulina is stated to be responsible for about 11 per cent. of the root diseases of rubber in Ceylon.

1922*d*. "Research Notes." *Bull. of Rubber Growers' Assoc.* IV, 107 (*Rev. Appl. Mycol.* 1923, II, 32).
In disease of rubber, *Ustulina* is associated with *Kretschmaria micropus*, each producing the same effect.

1922*e*. Small, W. "Ann. Rept. of Gov. Mycol. for 1921." *Ann. Rept. Dept. Agric. Uganda*, 1921, p. 49 (*Rev. Appl. Mycol.* 1923, II, 156).
The fungus is found in the colony but not on rubber; no indication as to hosts.

1922*f*. Tunstall, A. C. "Notes on fungus diseases during season 1922." *Quart. Journ. Sci. Dept. Indian Tea Assoc.* III, 115 (*Rev. Appl. Mycol.* 1923, II, 343).
Again reports *Ustulina* from India on tea, spreading from plant to plant via lateral roots as well as by spore infection of wounds. The disease is particularly prevalent on acid soils and therefore can be controlled by application of lime.

1922*g*. Bose, S. R. (Herb. Mus. Brit.)
Specimen No. 27 shows conidial fructification of *Ustulina* from collar of *Ficus obtusa* in the Madras Presidency.

1922*h*. Schrieke, G. C. "Het rubbertij. op het Schierland Malacca." *Arch. rubbercult. Ned.-Ind. Jaarg.* VI, 339.

1922*i*. Schrieke, G. C. "The rubber industry in Malaya." *Bull. Rubber Growers' Assoc.* IV, 434.
Mentions *Ustulina* as causing a disease of rubber in Malaya.

1923. Bateson, E. "Ann. Rept. of Mycol. and Agric. Advis. 1922." *Official Gaz. N. Borneo*, p. 80 (*Rev. Appl. Mycol.* 1924, III, 424).
States that *Ustulina* occurs only sporadically on rubber in North Borneo.

1923*a*. Van Hall, C. J. J. "Ziekten en plagen der cultuurgewassen in Ned.-Ind. 1922." *Meded. Inst. v. Plantenziekten*, LVIII (*Rev. Appl. Mycol.* 1924, III, 189).
Expresses the opinion that *Ustulina* merely causes a "cob-web" disease of rubber in the Dutch East Indies and does little damage.

1923*b*. Mitchell, J. "Ceylon rubber research Sch. 1921–2." *Malayan Tin and Rubber Journ.* XII, 929 (*Rev. Appl. Mycol.* 1924, III, 299).
Ustulina is said to be a frequent but not a serious disease of rubber in Ceylon.

1923*c*. Petch, T. "The disease of the tea bush," p. 198 (*Rev. Appl. Mycol.* 1924, III, 4).
Says that *Ustulina* is the commonest cause of root disease of tea in Ceylon and that the "tea" type of fungus is similar to the "rubber" type.

1923*d*. Pinching, H. C. "Rubber in Burma." *Bull. Rubber Growers' Assoc.* X, 647 (*Rev. Appl. Mycol.* 1924, III, 424).
Ustulina disease of rubber may follow attacks by white ants in Burma, but, generally speaking, is not serious.

1923*e*. Steinmann, A. "Aanvullende mededeeling over het optreten van Ustulina bij Hevea in Java." *Arch. v. de rubbercult. in Ned.-Ind. jaarg.* VII, 448.

1923*f*. Steinmann, A. "Some observations on the occurrence of *Ustulina* on rubber trees in Java." *Arch. v. de rubbercult. in Ned.-Ind. jaarg.* VII, 463.
First paper states *Ustulina* to be a slow-working parasite on rubber, spreading exclusively by spores. Emphatic that *U. vulgaris* and *U. zonata* are identical. Well illustrated by photographs and diagrams.
Second paper an English summary of the first.

1924. Oudemans, C. A. J. A. *Enumeratio systematica fungorum*, iv, 2.
Summarises the hosts on which *Ustulina* has been found as follows: *U. linearis* on silver birch. *U. vulgaris* on oak, willow, hornbeam, beech, elm, silver birch, sycamore, lime, poplar and *Citrus*.

1924*a*. Bernard, C. "Wortelziekten bij thee en rubber." *De thee*, v, 75 (*Rev. Appl. Mycol.* 1925, iv, 194).
Ustulina zonata is the principal root disease of tea and rubber in the Dutch East Indies.

1924*b*. Bernard, C. & Steinmann, A. "De wortelkraagziekte." *De thee*, v, 21 (*Rev. Appl. Mycol.* 1925, iv, 68).
Mainly a summary of previous papers. The type of *Ustulina* found on tea in Java corresponds exactly with the type found on tea in Ceylon. Favour the name *U. maxima*.

1924*c*. Bunting, R. H. "Appendix A. Rept. of research branch 1922." *Rept. Dept. Agric. Gold Coast*, p. 19 (*Rev. Appl. Mycol.* 1925, iv, 333).
Reports that disease caused by *Ustulina zonata* has been responsible for destruction of cocoa trees and for considerable damage to rubber trees on the Gold Coast.

1924*d*. Bunting, R. H. & Dade, H. A. *Gold Coast plant diseases*, p. 43.
Report *Ustulina* as being found on cocoa at Ashanti and on Para rubber and *Ficus* sp. at Coomassie. They state that it has been found in the Fiji Islands on mango, shaddock, orange and (fatally) on *Hibiscus*. Apparently (p. 101) both *Ustulina vulgaris* and *U. zonata* are found on the Gold Coast.

1924*e*. Van Overeem, C. "Ueber *Ustulina vulgaris* Tul. und *U. zonata* (Lév.) Sacc." *Bull. Jard. Bot. Buitenz.* Sér. 3, vi, 256 (*Rev. Appl. Mycol.* 1925, iv, 68).
Critically disapproves of the specific name *vulgaris* and prefers the adoption of *Ustulina maxima* (Web.) Wettst. as the name for both *U. vulgaris* and *U. zonata* which, he emphatically states, are undoubtedly identical; he disagrees with all specific differences mentioned previously and also asserts that both species are equally capable of dangerous parasitism but suggests that the European species may be handicapped by the environment. "*Ustulina maxima* wird in Europa meistens als harmloser Saprophyt betrachtet, aber ganz richtig ist diese Auffassung nicht. Mir sind Fälle bekannt, wo sie an alten Buchen in Holland stark schädigend auftrat, während sie auch in Frankreich an Linden als Schädling bekannt geworden ist."

1924*f*. Sharples, A. "Some observations on root disease of *Hevea brasiliensis*." *Malayan Agric. Journ.* xii, 404. Also in *Planters' Chron.* 1925, xx, 90 (*Rev. Appl. Mycol.* 1925, iv, 375).
Discusses Van Overeem and calls attention to the variability of growth-forms of *Ustulina* in the tropics; probably *Kretschmaria* only a growth-form of *Ustulina*.

1924*g*. Small, W. "A *Rhizoctonia* causing root disease in Uganda." *Trans. Brit. Mycol. Soc.* ix, 152.
Ustulina zonata is not found on *Grevillea robusta* in Uganda, the root disease being caused by *Rhizoctonia*; the only root diseases of tea are caused by *Rhizoctonia* and *Armillaria*.

1924*h*. Steinmann, A. "Korte aanteekenningen omtrent *Ustulina*." *Arch. v. de rubbercult. Ned.-Ind. jaarg.* viii, 140.
A note to the effect that the name should be *Ustulina maxima* (Web.) Wettst.

1925. Ashplant, H. T. "Ann. Rept. for 1924–5." *Planters' Chron.* xx, 440 (*Rev. Appl. Mycol.* 1926, v, 53).
The only root disease of rubber in Southern India is caused by *Ustulina zonata* and the attack is usually associated with infection by "patch canker" caused by a species of *Phytophthora*.

1925*a*. Wright, C. H. "The modern aspect of disease control." *India Rubber Journ.* lxx, 40 (*Rev. Appl. Mycol.* 1926, v, 323).
Comments on the damage caused by *Ustulina* (and other fungi) in Malaya.

1925*b*. Steinmann, A. "De ziekten en plagen von *Hevea* in Ned.-Ind." *Arch. Druk-Buitenz.* p. 24 (*Rev. Appl. Mycol.* 1925, iv, 701).
A good general account, with coloured illustrations, of effect of *Ustulina* on rubber in the Dutch East Indies. Fungus causes damage up to 20 per cent. on older trees in Malaya, but only occurs sporadically in Java and Sumatra. Gives details of infection, propagation, symptoms of disease and control measures.

1925*c*. Bernard, C. "Kankergezwellen op den Theestam." *De thee*, vi, 40 (*Rev. Appl. Mycol.* 1926, v, 522).
Reports secondary infection by *Ustulina* following crown gall (*B. tumefaciens*) on stems of tea in Java.

1925*d*. "Crude Rubber Co. Survey." *India Rubber Journ.* lxx, 13 (*Rev. Appl. Mycol.* 1926, v, 323).
Ustulina is said to be found in the Amazon valley on rubber.

1925*e*. Pinching, H. C. "Rubber diseases." *Malayan Tin and Rubber Journ.* xiv, 333 (*Rev. Appl. Mycol.* 1925, iv, 504).
Control of disease of rubber caused by *Ustulina* is difficult and not often effective.

1925*f*. Mitchell, J. *Third Rept. Rubber Research Scheme* (*Ceylon*), 1924 (*Rev. Appl. Mycol.* 1925, iv, 503).
Prevalence of infection by *Ustulina* may be reduced by adequate disinfection of latex spouts.

1926. Saccardo, P. A. *Sylloge fungorum*, xxiv, 1093.
Admits the following two species to the genus: *Ustulina Mori* K. Hara (allied to *U. microspora*) and *U. placentiformis* Rehm.

1926*a*. Wakefield, E. M. "Arundel Foray." *Trans. Brit. Mycol. Soc.* xii, 1.
Ustulina vulgaris is stated to be abundant on beech in the district of Arundel (England).

1926*b*. Government Order No. 44, Gold Coast Plants' Pests Ordinance, 1923 (*Rev. Appl. Mycol.* 1927, vi, 704).
Declares *Ustulina zonata* to be a "dangerous pest" on the stems and roots of cacao, on the Gold Coast.

1926*c*. Mitchell, J. "Fourth Rept. Rubber Research Scheme (Ceylon), 1925." *Trop. Agric.* lxvii, 8 (*Rev. Appl. Mycol.* 1926, v, 580).
Expresses the opinion that disease caused by *Ustulina* is likely to become the most serious factor in Ceylon rubber plantations, and should receive considerable attention.

1926*d*. Rhind, D. *Ann. Rept. of Mycol. Rangoon*, 1925 (*Rev. Appl. Mycol.* 1926, v, 344).

1926*e*. Rhind, D. "The disease of Para rubber in Burma." *Dept. of Agric. Burma Bull.* No. 14 (*Rev. Appl. Mycol.* 1927, vi, 182).
Ustulina is said to be the sole cause of disease of rubber in certain parts of Burma.

1926*f*. Fawcett, H. S. Citrus *diseases and their control*, p. 112.
States that *Ustulina* gains entrance into the roots of *Citrus* after water injury has killed them; the fungus gradually works up the roots, girdles the crown and causes a white rot of root and stem.

1926*g*. Van Hall, C. J. J. "Diseases and pests of rubber and tea in Java and Sumatra 1925." *Trop. Agric.* lxvii, 166.
Reports *Ustulina* on coffee from above district.

1926*h*. Weir, J. R. "Path. survey of Para rubber tree in Amazon valley." *U.S. Dept. of Agric. Bull.* No. 1380, p. 13.

The "black line rot fungus" (*Ustulina zonata*) causes a serious decay of rubber in the form of a canker in which no other fungus could be demonstrated. Infection is at the base of trees and the canker originates on lateral roots and spreads about a foot up the trunk; progress of the disease is slow. Attacked trees are usually on high and well-drained soil and the author compares this with the temperate *U. vulgaris* which "is found typically on Maple and also associated with dry sites."

Another (unnamed) species is mentioned, but inadequately described, as being conspicuous on dead and living stumps in the district.

The article contains all the usual details, illustrations and extensive bibliography.

1926*i*. Small, W. "*Rhizoctonia bataticola* (Taub.) Butler." *Trop. Agric.* lxvii, 237 (*Rev. Appl. Mycol.* 1927, vi, 439).

1926*j*. Small, W. "Further notes on *Rhizoctonia*." *Trop. Agric.* lxvii, 323 (*Rev. Appl. Mycol.* 1927, vi, 439).

Ustulina zonata is reported on stems of cacao in Ceylon, but is said to be a secondary infection following *Rhizoctonia bataticola*.

1926*k*. Stoughton-Harris, R. H. *Fourth Rept. Rubber Research Scheme* (*Ceylon*), 1925–6, p. 22 (*Rev. Appl. Mycol.* 1926, v, 581).

1926*l*. Stoughton-Harris, R. H. "Prelim. Rept. on method of treatment for *Ustulina* collar rot." *Fourth Quart. Circ. Rubber Research Scheme* (*Ceylon*), 1926, p. 10 (*Rev. Appl. Mycol.* 1926, v, 691).

Comments on control measures for *Ustulina* and suggests cutting cavities and filling with cement.

1927. Bateson, E. "Rubber in North Borneo." *Rubber Growers' Assoc. Bull.* ix, 511 (*Rev. Appl. Mycol.* 1927, vi, 750).

Remarks that *Ustulina* is uncommon in North Borneo.

1927*a*. Bunting, R. H. "Diseases of cocoa and measures for control." *Proc. First W. Afr. Cong.* p. 86 (*Rev. Appl. Mycol.* 1928, vii, 93).

States that *Ustulina zonata* is found on dead stems of cocoa in Gold Coast Colony but not known to be pathogenic.

1927*b*. Bunting, R. H. "Cocoa disease proscribed by Plants' Inj. Pests Order." *Gold Coast Dept. Agric. Bull.* No. 11 (*Rev. Appl. Mycol.* 1928, vii, 565).

Describes, with coloured plates, diseases of cocoa in the colony and includes "collar rot" caused by *Ustulina*.

1927*c*. Dade, H. A. *Rept. Agric. Dept. Gold Coast Colony*, 1926 (*Rev. Appl. Mycol.* 1927, vi, 145).

Ustulina is the cause of collar rot of cocoa in Gold Coast; infection is associated with previous attacks of boring beetles.

1927*d*. Deighton, F. C. *Mycol. Sect. Ann. Rept. Lands and Forests Dept. Sierra Leone*, 1926 (*Rev. Appl. Mycol.* 1928, vii, 305).

Says that rubber is seriously affected by *Ustulina* in Sierra Leone.

1927*e*. Mitchell, J. *Fifth Rept. Rubber Research Scheme* (*Ceylon*), 1926 (*Rev. Appl. Mycol.* 1927, vi, 575).

Disease of rubber caused by *Ustulina* is widespread in Ceylon and there are few attempts at control.

1927*f*. Sharples, A. "Ann. Rept. of Mycol. 1926." *Malayan Agric. Journ.* xv, 152 (*Rev. Appl. Mycol.* 1927, vi, 656).

Ustulina is said to cause considerable loss of rubber in Malaya.

1927*g*. Small, W. *Mycol. Div. Ceylon Adminis. Rept.* 1926 (*Rev. Appl. Mycol.* 1928, vii, 224).

Disease of rubber in Ceylon is mainly caused by *Rhizoctonia bataticola*; *Ustulina* is merely a secondary infection following the *Rhizoctonia*.

1927*h*. Small, W. "Recent work on root diseases of economic and other plants in Ceylon." *Trop. Agric.* LXVIII, 201 (*Rev. Appl. Mycol.* 1927, VI, 629).
Further investigation demonstrates that while *Rhizoctonia* is invariably present it appears doubtful if any other fungus, such as *Ustulina*, is ever found alone. Inoculation experiments show that *Ustulina* is, at best, merely a weak wound parasite and Small suggests that *Rhizoctonia* may prove to be of greater significance than any of the other fungi previously regarded as dangerous parasites.

1927*i*. Steinmann, A. "Een bijzonder geval van *Ustulina maxima*." *De Thee*, VII, 169 (*Rev. Appl. Mycol.* 1928, VII, 64).
Reports *Ustulina* on tea in Java.

1927*j*. Steinmann, A. "Diseases and pests of *Hevea* in Nether-Indies." *Biol. Abstr.* 1931, V, p. 1038, No. 10555.
An English summary of the Dutch text of the 1925 edition, with coloured plates and illustrations.

1927*k*. Ultée, A. J. "Verslag over de werkzaamheden v. h. Proef. Malang. i. h. jaar. 1926." *Meded. Proefs. Melang.* p. 62 (*Rev. Appl. Mycol.* 1928, VII, 20).
States that rubber is attacked by *Ustulina* in Assam.

1927*l*. Weir, J. R. "Problems of *Dichrostachys nutans*, a weed tree in Cuba with remarks on its pathology." *Phytop.* XVII, 137 (*Rev. Appl. Mycol.* 1927, VI, 521).
An account of *Ustulina zonata* attacking the Marabou tree in Cuba.

1927*m*. Britton-Jones, H. R. "Mycol. notes on *Rhizoctonia bataticola*." *Trop. Agric.* IV, 147.
Comments on Small's papers and says that his findings are "of immense importance" and though these results are supported in some respects but questioned in others, the author is prepared to accept the view that such fungi as *Ustulina* are of secondary importance as compared with *Rhizoctonia*.

1928. Miller, J. H. "Biological studies in Sphaeriales. II." *Mycologia*, XX, 327.
Suggests that the segregation of the genus *Ustulina* by Tulasne is based on insufficient grounds and should, therefore, be reincluded in *Hypoxylon*.

1928*a*. Butler, E. J. "Rept. on some diseases of tea and tobacco in Nyasaland." *Dept. of Agric. Nyasaland* (*Rev. Appl. Mycol.* 1929, VIII, 203).
Root diseases of mature tea in above district occurred only on trees affected by collar-crack or other diseases; on young bushes, however, *Ustulina zonata* was occasionally found alone.

1928*b*. Gadd, C. H. "Treatment of tea root diseases; diagnosis and control." *Planters' Chron.* XXIII, 613 (*Rev. Appl. Mycol.* 1929, VIII, 69).
Suggests control measures for root disease caused by *Ustulina*.

1928*c*. Gadd, C. H. *Rept. of Mycol. Tea Research Inst. Ceylon, Bull.* No. 2 (*Rev. Appl. Mycol.* 1928, VII, 745).
In Ceylon, wood rot and branch canker of tea are connected with *Ustulina*.

1928*d*. Petch, T. "The parasitism of tea root disease fungi." *Tea Quart.* I, 10 (*Rev. Appl. Mycol.* 1928, VII, 543).
Criticises the pure culture methods of Brooks and of Sharples, both of whom show that *Ustulina* is a wound parasite, whereas Petch states that, in the field, infection can take place merely via contact of lateral roots.

1928*e*. Petch, T. "Tropical root disease fungi." *Trans. Brit. Mycol. Soc.* XIII, 240 (*Rev. Appl. Mycol.* 1929, VIII, 267).
Discusses Van Overeem and agrees that *Ustulina vulgaris* and *U. zonata* are identical; the name of the species should be *U. deusta* (already suggested by Petrak, 1921).

1928*f*. Petch, T. "Notes on root diseases." *Tea Quart.* I, 104 (*Rev. Appl. Mycol.* 1929, VIII, 202).
The association between *Ustulina* on dead *Grevillea* and living tea also occurs in Java.

1928*g*. Staner, P. "Belgian Congo fungi and insects new to the Colony." *Internat. Rev. of Agric.* N.S. XIX, 399.
Ustulina zonata is said to attack *Hevea* in the Belgian Congo.

1928*h*. Steinmann, A. "Over de *Diplodia*—wortelziekte v. d. Thee." *Arch. v. Thee cult. Ned.-Ind.* II, 59 (*Rev. Appl. Mycol.* 1929, VIII, 71).
Comments on the enormous loss of tea by such fungi as *Ustulina* in the Dutch East Indies. Attaches no importance to the view that soil reaction influences infection by *Ustulina*.

1928*i*. Wakefield, E. M. "Littlehampton Foray." *Trans. Brit. Mycol. Soc.* XIV, 185.
Reports *Ustulina* from the above district of England, on beech and horse-chestnut.

1928*j*. Small, W. "On *Rhizoctonia bataticola* (Taub.) Butler as a cause of root disease in the tropics." *Trans. Brit. Mycol. Soc.* XIII, 40 (*Rev. Appl. Mycol.* 1928, VII, 604).
Having investigated the occurrence of *Rhizoctonia* in Ceylon and Uganda again emphasises the economic importance of this fungus. A selective examination of the statements leads to the conclusion that Small never admits *Ustulina* to be the primary cause of any disease on any host. Supposedly clear-cut cases of disease by this fungus are said to be "complicated in reality and without exception by the presence of *Rhizoctonia*." In view of the author's admission that in the absence of results of inoculation experiments there is a "certain amount of conjecture which is unavoidable at the moment," direct criticism of the observational method of determining the status of the causal organism by the "presence and absence" theory may be suspended, but it might be remarked that mere presence is not a criterion of importance, and also from the economic point of view a secondary infection is not necessarily less devastating than a primary one.

1928*k*. Saccardo, P. A. *Sylloge fungorum*, XXIV, Append. add. ad vols. XXIII–XXIV, Sect. 2, p. 1335.
Adds *Ustulina brachyspora* Speg. to the list of species in the genus.

1929. Gadd, C. H. "*Rhizoctonia bataticola* and tea root diseases." *Trans. Brit. Mycol. Soc.* XIV, 99.
Comments on the opinion expressed by Small, 1928, and says that in Small's view the fungus which is given greater importance, *i.e. Rhizoctonia*, is the one in which there is less evidence of dangerous parasitism and goes on to say "as the evidence stands at present I see no reason for saying that *R. bataticola* ever causes a pathological condition of tea." This view would restore *Ustulina* to its previous pathological status.

1929*a*. Gadd, C. H. "Pruning in relation to wood rot of tea." *Tea Quart.* II, 10 (*Rev. Appl. Mycol.* 1929, VIII, 470).
Discusses control of wood rot of tea caused by *Ustulina*.

1929*b*. Costantin, J. "Biologie culturale et pathologique de l'*Hevea brasiliensis* en Indo-Chine." *Ann. Sci. Nat. Bot.* Sér. 10, XI, XII (*Rev. Appl. Mycol.* 1930, IX, 404).
Gives notes on the common diseases of rubber including *Ustulina*, and comments on control measures.

1929*c*. Mitchell, J. *Rept. Rubber Research Scheme, Ceylon*, 1928 (*Rev. Appl. Mycol.* 1929, VIII, 598).
Ustulina is the most prevalent cause of root disease of rubber in Ceylon, older trees being the more susceptible.

1929*d*. Weir, J. R. "Ann. Rept. 1928. Pathol. Div." *Ann. Rept. Rubber Inst. Malaya*, p. 61 (*Rev. Appl. Mycol.* 1930, IX, 127).
Finds *Ustulina* on rubber in Malaya, following wounds caused by sunscorch, fire or mechanical injuries. In comparison with Small's work on *Rhizoctonia* it is interesting that Weir isolated this fungus from the roots of *Hevea* and tested its parasitism with negative results.

1929*e*. Tunstall, A. C. "Fungi on tea roots." *Quart. Journ. Indian Tea Assoc.* I, 1 (*Rev. Appl. Mycol.* 1929, VIII, 611).
Gives notes on symptoms, life history, distribution and control of certain fungi (including *Ustulina*) responsible for disease of tea in Ceylon. Suggests that *U. zonata* is probably identical with *Kretschmaria micropus*.

1929*f*. Seymour, A. B. *Host index of the Fungi of North America*, p. 11.
Mentions certain fungi, including *Stilbum Ustulinae*, that are supposedly parasitic on *Ustulina*, but, in spite of an exhaustive list of trees, etc., which have repeatedly been given as hosts of *Ustulina*, he finds the fungus only on *Quercus* sp. (p. 267).

1930. Park, M. *Rept. Mycol. Div. Ceylon Dept. Agric.* 1929, p. 1 (*Rev. Appl. Mycol.* 1931, X, 79).
Finds branch canker of tea caused by *Ustulina* at mid- and low-country elevations in Ceylon and states that incidence of disease is associated with the method and time of pruning.

1930*a*. Tunstall, A. C. "Some notes on the treatment of blights." *Quart. Journ. Indian Tea Assoc.* IV, 191 (*Rev. Appl. Mycol.* 1931, X, 345).
Deals with the control of "charcoal stump rot" of tea caused by *Ustulina* and advocates the removal of all diseased bushes as well as all neighbouring, apparently healthy, ones as the only effective method.

1930*b*. Mitchell, J. *Org. Sec. Rept.* 1929 (*Rev. Appl. Mycol.* 1930, IX, 672).
Repeats previous control measures for *Ustulina* on rubber.

1930*c*. Sharples, A. *Ann. Rept. Dept. of Agric. Straits Settlement and Federated Malay States*, 1929 (*Rev. Appl. Mycol.* 1931, X, 160).
Ustulina zonata is reported on tea roots in Malaya.

1930*d*. Miller, J. H. "British Xylariaceae." *Trans. Brit. Mycol. Soc.* XV, 134.
Classifying the genera *Hypoxylon, Camarops* and *Daldinia*, reinstates the common British *Ustulina* in the genus *Hypoxylon* "because it has the fundamental characters of the generic concept" and reverts to the name *Hypoxylon ustulatum* Bull. As type specimen he refers to Fries *Scler. suec.* No. 261. One specimen is given as being found on *Taxus*.

1931. Steinmann, A. "Overzicht v. d. ziekten en plagen v. groenbemesters over 1930." *De Bergcultures*, 1931, p. 255 (*Rev. Appl. Mycol.* 1931, X, 525).
Reports a new host, *Leucaena glauca*, for *Ustulina* in Central Java and Sumatra.

1931*a*. Wakefield, E. M. "The Whitby Foray." *Trans. Brit. Mycol. Soc.* XVI, 7.
Finds *Ustulina* in the above district on beech.

1932. Campbell, A. H. "Zone lines in plant tissues. I. The black lines formed by *Xylaria polymorpha*." *Ann. Appl. Biol.* XX, 123.
Discusses the significance of black lines in *Xylaria* and states that those of *Ustulina* are essentially similar.

1932*a*. Murray, R. K. S. "Diseases of rubber in Ceylon." *Fourth Quart. Circ. Rubber Research Scheme*, 1931, VIII, 39 (*Rev. Appl. Mycol.* 1932, XI, 400).
In mature areas *Ustulina zonata* "develops to an alarming extent" and treatment should receive adequate attention.

1932*b*. Ramsbottom, J. *Fungi in Die Buchenwälder Europas*, p. 356.
States that *Ustulina vulgaris* is a common parasite of beech in England.

1932*c*. Sharples, A. *Ann. Rept. Pathol. Div. Rubber Res. Inst. Malaya*, 1931, p. 84 (*Rev. Appl. Mycol.* 1932, xi, 672).
Disease caused by *Ustulina* is quite common, but the attack is usually associated with some other fungus, often *Sphaerostilbe repens*.

1932*d*. Sharples, A. & Sanderson, A. R. "The root disease problem on old rubber areas in Malaya." *Rubber Res. Inst. Malaya Bull.* iii, 1931, p. 11 (*Rev. Appl. Mycol.* 1932, xi, 325).
The incidence of disease caused by *Ustulina* increases with the age of the trees but is not serious, the average incidence being rather more than 1 per cent. It is said rarely to cause primary infection.

1932*e*. Staner, P. "Quelques maladies de l'*Hevea*." *Bull. Agric. Congo Belge*, xxi, 653 (*Rev. Appl. Mycol.* 1932, xi, 2).
Gives key for diagnosis of the more important diseases of rubber in the Belgian Congo, including *Ustulina* rot. *Ustulina* is said to be a wound parasite spreading by spores.

INDEX OF HOST PLANTS

Ustulina vulgaris Tul. and *Ustulina zonata* (Lév.) Sacc.

Abies pectinata. Italy: Saccardo & Cavara, 1900*a*.
Acer rubrum. U.S.A.: Farlow, 1915*b*.
Albizzia. Ceylon: Petch, 1910, 1912.
Areca nut palm. Singapore: South, 1920.
Ash. Denmark: Lind, 1913. England: Bolton, 1791; Massee & Crossland, 1905.
Bamboo. Dutch East Indies: Berkeley, 1879*a*.
Beech. Austria: Wettstein, 1885*a*. Belgium: Kickx, 1867. Bohemia: Thümen, 1872. Corsica: Maire, Dumée & Lutz, 1901; Traverso, 1906. Denmark: Lind, 1913. England: Broome, 1886; Petch, 1907; Plowright, 1873*a*; Ramsbottom, 1932*b*; Wakefield, 1926*a*, 1928*i*, 1931*a*. France: Fabre, 1878; Tulasne, 1863*a*. Germany: Fuckel, 1869; Kunze, 1875; Martius, 1817; Nitschke, 1867*a*; Rehm, 1892*c*; Schröter, 1908; Sydow, 1890*a*; Timm, 1838; Tode, 1790; Weber, 1778; Wehmer, 1896. Holland: Oudemans, 1884, 1897*a*; Van Overeem, 1924*e*. Italy: Berlese & Peglion, 1892*b*; Bizzozero, 1885*b*; Bresadola & Saccardo, 1897*b*; Colla, 1837*a*; Cummino, 1805*a*; Saccardo, 1873; Savi, 1825; Schlectendahl, 1824; Traverso, 1906. Scandinavia: Fries, 1823. Switzerland: Jaczewski, 1895*b*.
Berrya ammomilla. Ceylon: Petch, 1914*a*.
Birch. Germany: Rehm, 1892*c*; Sydow, 1890*a* (*B. alba*).
Canarium commune. Singapore: Chipp, 1920*a*.
Cassia nodosa. Ceylon: Petch, 1912, 1914*a*.
Casuarina montana. Ceylon: Petch, 1914*a*.
Celtis australis. Corsica: Traverso, 1906. Italy: Saccardo, D., 1897*d*; Traverso, 1906.
Chestnut. Corsica: Traverso, 1906. Italy: Savi, 1825; Traverso, 1906.
Citharexylon cyanocarpon. Chili: Gay, 1850*a*.
Citrus aurantium. Ceylon: Petch, 1912, 1914*a* (*C. decumana*). Corsica: Traverso, 1906. Fiji Islands: Bunting & Dade, 1924*d*; Knowles, 1919*a*. Italy: Penzig, 1882, 1887*a*; Rabenhorst, 1850; Traverso, 1906. U.S.A.: Fawcett, 1926*f*.
Cocoa. Ceylon: Petch, 1916*c*; Small, 1926*i*, 1926*j*. Dutch East Indies: Bernard, 1918*b*. Gold Coast: Bunting, 1924*c*, 1927*a*, 1927*b*; Bunting & Dade, 1924*d*; Dade, 1927*c*; Govt. Order, 1926*b*.
Coffee. Dutch East Indies: Van Hall, 1926*g*. Kenya: Macdonald, 1922*b*.
Derris robusta. Ceylon: Petch, 1914*a*.
Ebony. Ceylon: Petch, 1921*d*.
Elm. Denmark: Lind, 1913. France: Tulasne, 1863*a*.
Eucalyptus. Malaya: Chipp, 1920*a*.

Eugenia. Ceylon: Petch, 1916*c*.
Ficus. Gold Coast: Bunting & Dade, 1924*d*. Madras: Bose, 1922*g* (*F. obtusa*).
Grevillea. Ceylon: Petch, 1910. Tropics: Delacroix & Maublanc, 1911.
Halmilla. Ceylon: Petch, 1916*c*.
Hibiscus. Fiji Islands: Bunting & Dade, 1924*d*; Knowles, 1919*a*.
Hornbeam. Corsica: Traverso, 1906. Denmark: Lind, 1913. France: Tulasne, 1863*a*. Germany: Kunze, 1875; Nitschke, 1867*a*. Italy: Bizzozero, 1885*b*; Schlectendahl, 1824; Traverso, 1906.
Horse-chestnut. Denmark: Lind, 1913. England: Wakefield, 1928*i*.
Lafoensis vandelliana. Ceylon: Petch, 1912, 1914*a*.
Laucaena glauca. Dutch East Indies: Steinmann, 1931.
Laurel. Italy: Micheli, 1729.
Lime. Denmark: Lind, 1913. France: Van Overeem, 1924*e*. Germany: Sydow, 1890*a*; Wehmer, 1896. Italy: Bizzozero, 1885*b*.
Lunumidella. Ceylon: Petch, 1916*c*.
Mango. Fiji Islands: Bunting & Dade, 1924*d*; Knowles, 1919*a*.
Maple. France: Richon, 1889.
Marabou. Cuba: Weir, 1927*l*.
Melia dubia. Ceylon: Petch, 1914*a*.
Oak. Corsica: Traverso, 1906. England: Massee & Crossland, 1905. Germany: Martius, 1817. Hungary: Linhart, 1882*b*. Italy: Passerini, 1867*b*; Savi, 1825; Traverso, 1906. U.S.A.: Ellis & Everhart, 1892*a*; Farlow & Seymour, 1888 (*Quercus virens*); Seymour, 1929*f*.
Palm. Dutch East Indies: Höhnel, 1909*a*; Léveillé, 1845. Uganda: Maitland, 1915*a* (*Phoenix reclinata*).
Peach. Kenya: Macdonald, 1922*b*.
Pear. Kenya: Macdonald, 1922*b*.
Poplar. Denmark: Lind, 1913. France: Richon, 1889. Italy: Cesati & de Notaris, 1863.
Pumelo. Ceylon: Petch, 1916*c*.
Rubber. Amazon Valley: Crude Rubber Co. 1925*d*; Weir, 1926*h*. Assam: Ultée, 1927*k*. Belgian Congo: Staner, 1928*g*, 1932*e*. North Borneo: Bateson, 1923, 1927. Burma: Pinching, 1923*d*; Rhind, 1926*d*, 1926*e*. Ceylon: Bryce, 1916*d*; Jardine, 1922; Mitchell, 1916*e*, 1923*b*, 1925*f*, 1926*c*, 1927*e*, 1929*c*, 1930*b*; Murray, 1932*a*; Petch, 1921*c*, 1921*d*, 1922*c*; Reeves, 1922; Small, 1927*h*; Stoughton-Harris, 1926*k*, 1926*l*. Dutch East Indies: Bernard, 1924*a*; Rutgers, 1920*b*; Steinmann, 1923*e*, 1923*f*, 1925*b*; Swart, 1918*f*; Van Hall, 1921*a*. Fiji Islands: Knowles, 1919*a*. Gold Coast: Bunting, 1924*c*; Bunting & Dade, 1924*d*. South India: Ashplant, 1925. Indo-China: Costantin, 1929*b*. Kenya: Macdonald, 1922*b*. Malaya: Belgrave, 1917; Brooks, 1914*c*, 1915; Pinching, 1925*e*; Schrieke, 1922*h*, 1922*i*; Sharples, 1916, 1916*a*, 1916*b*, 1918*e*, 1927*f*, 1932*c*; Sharples & Belgrave, 1917*b*; Sharples & Sanderson, 1932*d*; Weir, 1929*d*; Wright, 1925*a*. Nigeria: Wakefield, 1917*a*. Philippines: Webster, 1917*d*. Sierra Leone: Deighton, 1927*d*.
Scolopia. Ceylon: Petch, 1921*d*.
Shaddock. Fiji Islands: Bunting & Dade, 1924*d*.
Sycamore. Denmark: Lind, 1913.
Tea. Ceylon: Butler, 1918; Gadd, 1928*b*, 1928*c*, 1929, 1929*a*; Jardine, 1922; Park, 1930; Petch, 1907, 1910, 1912, 1916*c*, 1923*c*, 1928*d*, 1928*e*, 1928*f*; Reeves, 1922; Tunstall, 1929*e*. Dutch East Indies: Bernard, 1918*a*, 1919, 1924*a*, 1925*c*; Bernard & Steinmann, 1924*b*; Palm, 1918*c*; Steinmann, 1927*i*, 1927*j*, 1928*h*; Van Hall, 1921*b*, 1923*a*. North-East India: Butler, 1918; Tunstall, 1918*g*, 1922*f*, 1930*a*. Kenya: Macdonald, 1922*b*. Malaya: Sharples, 1930*c*. Nyassaland: Butler, 1928*a*. Tropics: Delacroix & Maublanc, 1911.
Tephrosia candida. Dutch East Indies: Bernard, 1918*a*.
Tobacco. Nyassaland: Butler, 1928*a*.

Willow. BELGIUM: Kickx, 1835, 1867. GERMANY: Martius, 1817. HOLLAND: Oudemans, 1884; Westendorp, 1866. NETHERLANDS: Dozy & Molkenboer, 1846.
Yew. ENGLAND: Miller, 1930*d*.

Ustulina tubulina (A. & S.) Schröt. (?= *U. maxima*)

Alder. GERMANY: Albertini & Schweinitz, 1805.
Silver fir. GERMANY: Schröter, 1908.

Ustulina microsperma Trav.

Oak. ITALY: Traverso, 1906.

Ustulina Mori K. Haru

Mulberry. JAPAN: Tanaka, 1918*d*.

Ustulina brachyspora Speg.

Citrus aurantium v. *amara.* PARAGUAY: Spegazzini, 1920*c*.

ALPHABETICAL LIST OF AUTHORS

AUTHOR	YEAR
Albertini, I. B. & Schweinitz, L. D. de	1805
Amo y Mora, M. del	1870*a*
Ashplant, H. T.	1925
Balbis, G. B.	1804
Bateson, E.	1923, 1927
Belgrave, W. N. C.	1917
Berkeley, M. J.	1860, 1876, 1879*a*
Berlese, A. N. & Peglion, N.	1892*b*
Bernard, C.	1918*a*, 1918*b*, 1919, 1924*a*, 1925*c*
Bernard, C. & Steinmann, A.	1924*b*
Biroli, J.	1808
Bizzozero, G.	1885*b*
Bolton, J.	1791
Bommer, E. & Rousseau, M.	1884*a*
Bose, S. R.	1922*g*
Bresadola, G. & Saccardo, P. A.	1897*b*
Britton-Jones, H. R.	1927*m*
Brooks, F. T.	1914*c*, 1915
Broome, C. E.	1886
Bryce, G.	1916*d*, 1921*e*
Bucknall, C.	1877
Bulliard, P.	1791*a*
Bunting, R. H.	1924*c*, 1927*a*, 1927*b*
Bunting, R. H. & Dade, H. A.	1924*d*
Butler, E. J.	1918, 1928*a*
Campbell, A. H.	1932
Cesati, V.	1879
Cesati, V. & Notaris, G. de	1863
Chipp, T. F.	1920*a*
Colla, L.	1837*a*
Cooke, M. C.	1871*a*, 1883, 1892
Costantin, J.	1929*b*
Cristofori, J. de & Jan, G.	1832
Crude Rubber Co. Survey	1925*d*
Cummino, U.	1805*a*
Currey, F.	1859
Dade, H. A.	1927*c*
Deighton, F. C.	1927*d*
Delacroix, G. & Maublanc, A.	1911
Dickson, J.	1785
Dozy, F. & Molkenboer, J. H.	1846
Eaton, B. J.	1922*a*
Elliot, W. R.	1892*d*
Ellis, J. B. & Everhart, B. M.	1892*a*
Fabre, J. H.	1878
Farlow, W. G.	1915*b*
Farlow, W. G. & Seymour, A. B.	1888
Fawcett, H. S.	1926*f*
Fénix, E.	1911*b*
Fries, E.	1823, 1846*a*
Fuckel, L.	1869
Gadd, C. H.	1928*b*, 1928*c*, 1929, 1929*a*
Gay, C.	1850*a*
Govt. Order	1926*b*
Greville, R. K.	1824*a*, 1828
Haller, A. von	1742, 1768
Hennings, P.	1900
Hoffmann, G. F.	1787
Hohenbuhul-Heufler, L. J. von	1871
Höhnel, F. von	1909*a*
Hooker, W. J.	1821*a*, 1836
Hudson, G.	1778*a*
Jaczewski, M. A. de	1895*b*
Jardine, N. K.	1922
Kickx, J.	1835
Knowles, C. H.	1919*a*
Kunze, J.	1875
Lamarck, J. & Candolle, A. P. de	1805*b*
Lambotte, D. M. E.	1880
Latourette, M. A. L. C. de	1785*a*

AUTHOR	YEAR
Léveillé, J. H.	1845
Lind, J.	1913
Lindau, G.	1897*c*
Linhart, G.	1882*b*
Lloyd, C. G.	1921*g*
Macdonald, J.	1922*b*, 1923*b*
Maire, R., Dumée, P. & Lutz, L.	1901
Maitland, T. D.	1915*a*
Martius, C. F. P. von	1817
Massee, G. & Crossland, C. C.	1905
Maublanc, A.	1914
McAlpine, D.	1895
Micheli, P. A.	1729
Miller, J. H.	1928, 1930*d*
Mitchell, J.	1916*e*, 1923*b*, 1925*f*, 1926*c*, 1927*e*, 1929*c*, 1930*b*
Montagne, J. F. C.	1840, 1856, 1858
Mougeot, J. B., Nestler, C. & Schimper, W. P.	1843
Murray, R. K. S.	1932*a*
Nees, von E.	1816
Nitschke, T.	1867*a*
Nocca, O. & Balbis, G. B.	1821
Oudemans, C. A. J. A.	1884, 1897*a*, 1924
Palm, B.	1918*c*
Palmer, E.	1889*a*
Park, M.	1930
Passerini, G.	1867*b*
Patouillard, N.	1902
Penzig, O.	1882, 1887*a*
Penzig, O. & Saccardo, P. A.	1897
Persoon, C. E.	1796, 1801
Petch, T.	1907, 1910, 1911*a*, 1912, 1914*a*, 1916*c*, 1921*c*, 1921*d*, 1922*c*, 1923*c*, 1928*d*, 1928*e*, 1928*f*
Petrak, F.	1913*b*, 1916*f*, 1918*h*, 1920*d*, 1921
Pinching, H. C.	1923*d*, 1925*e*
Plowright, C. B.	1873*a*
Rabenhorst, L.	1850
Ramsbottom, J.	1932*b*
Re, F.	1826
Reeves, A. T.	1922
Rehm, H.	1892*c*, 1914*b*
Relhan, R.	1802
Research Notes	1922*d*
Rhind, D.	1926*d*, 1926*e*
Richon, C.	1889
Roumeguère, C.	1870
Rutgers, A. A. L.	1920*b*
Saccardo, D.	1897*d*
Saccardo, P. A.	1873, 1882*a*, 1891, 1895*a*, 1904, 1913*a*, 1926, 1928*k*
Saccardo, P. A. & Berlese, A. N.	1885
Saccardo, P. A. & Cavara, V.	1900*a*
Savi, C.	1825
Schlectendahl, D. F. L. de	1824
Schmidt, I. C.	1823*a*
Schrieke, G. C.	1922*h*, 1922*i*
Schröter, J.	1908
Schumacher, C. F.	1801*a*
Schweinitz, L. D. de	1822, 1834
Seymour, A. B.	1929*f*
Sharples, A.	1916, 1916*a*, 1916*b*, 1918*e*, 1924*f*, 1927*f*, 1930*c*, 1932*c*
Sharples, A. & Belgrave, W. N. C.	1917*b*
Sharples, A. & Sanderson, A. R.	1932*d*
Small, W.	1922*e*, 1924*g*, 1926*i*, 1926*j*, 1927*g*, 1927*h*, 1928*j*
Snowdon, J. D.	1921*f*
South, F. W.	1920
Sowerby, J.	1803
Spegazzini, C.	1881, 1884*b*, 1889*b*, 1920*c*
Staner, P.	1928*g*, 1932*e*
Steinmann, A.	1923*e*, 1923*f*, 1924*h*, 1925*b*, 1927*i*, 1927*j*, 1928*h*, 1931
Stoughton-Harris, R. H.	1926*k*, 1926*l*
Swart, N. L.	1918*f*
Sydow, P.	1890*a*
Tanaka, T.	1918*d*
Theissen, F. von	1908*a*, 1908*b*, 1909
Thümen, F. von	1872
Timm, I. C.	1838
Tode, H. J.	1790
Tommasini, M. & Biasoletto, B.	1837
Traverso, J. B.	1906
Tulasne, L. R. & C.	1863*a*
Tunstall, A. C.	1918*g*, 1922*f*, 1929*e*, 1930*a*
Ultée, A. J.	1927*k*
Van Hall, C. J. J.	1921*a*, 1921*b*, 1923*a*, 1926*g*
Van Overeem, C.	1924*e*
Wahlenberg, G.	1812
Wallroth, F. G.	1833
Wakefield, E. M.	1917*a*, 1926*a*, 1928*i*, 1931*a*
Weber, G. H.	1778
Webster, P. J.	1917*d*
Wehmer, C.	1896
Weir, J. R.	1926*h*, 1927*l*, 1929*d*
Westendorp, G. D.	1866
Wettstein, R. von	1885*a*
Wiggers, F. H.	1780
Wildemann, E. & Durand, Th.	1898
Winter, G.	1887
Withering, W.	1830
Wright, C. H.	1925*a*
Zopf, W.	1890

PROCEEDINGS

Meeting held at University College, London, Nov. 18th, 1933, Professor W. Brown, President, in the Chair.

K. W. Neatby. Recent Advances in Plant Breeding for Disease Resistance, with Special Reference to the Rust Problem.

The problem of breeding varieties of wheat resistant to stem rust has become greatly simplified during the past eight or ten years. The difficulties due to the existence of many physiologic forms of *Puccinia graminis Tritici* are more apparent than real. Firstly, in crosses between resistant and susceptible varieties the factors which control the inheritance of the reaction to one physiologic form usually also control the inheritance of reaction to a number of others. In crosses between Garnet or Reward (susceptible) and Marquillo (resistant) the seedling reaction in the greenhouse to form 21 is a reliable index of the field reaction when many forms are included in the epidemic. This suggests that the factors which control the inheritance of the reaction to form 21, in these crosses, also control the inheritance of the reaction to many, if not all, others to which Marquillo is resistant. Secondly, certain varieties, though susceptible in the seedling stage, develop a high degree of resistance as they approach maturity. This resistance is simply inherited, and inherited independently of the greenhouse seedling reaction. Strains of wheat have now been developed which combine this high field resistance with high quality and other desirable characters.

A. H. R. Buller. *Tilletia Tritici* and the Discharge of its True Basidiospores.

The recent work of Buller and Vanterpool on *Tilletia Tritici* (in course of publication in vol. v of Buller's *Researches on Fungi*) was reviewed. Six variations in the development of the primary and secondary conidia were recorded. The development and violent discharge of the so-called secondary conidia of *T. Tritici* were described in detail. A secondary conidium takes 1·25–1·5 hours to develop from a tiny rudiment to maturity. As soon as it is mature it is shot away from its sterigma along with a drop of liquid excreted at its hilum.

The authors' theoretical conclusions in regard to the nature of the basidium of *T. Tritici* which differ from those of Brefeld and others are: (1) the sickle-shaped so-called secondary conidia of Brefeld and others are the true basidiospores; and (2) the long slender primary conidia of Brefeld and others are sterigmata of a highly specialised kind.

Conjugation in *T. Tritici* takes place at an earlier stage than in the heterothallic Hymenomycetes, for the conjugating elements are two haploid sterigmata instead of two haploid mycelia derived from basidiospores.

The asymmetrical development of the basidiospores of *T. Tritici* and their violent discharge with drop excretion is in exact conformity with what is found in the Hymenomycetes and the Uredineae. This fact strongly supports the view that the Tilletiaceae belong to the great group of the Basidiomycetes.

Increasing specialisation of the sterigmatic part of the basidium is exhibited in the series: (1) *Psalliota*, (2) *Tulasnella*, (3) *Urocystis Violae*, (4) *Tubercinia Trientalis*, and *Tilletia Tritici*.

H. Crutchlow. Notes on Forms of *Synchytrium* from North Wales.

Dr A. S. Horne found *Synchytrium* in North Wales growing upon *Potentilla Fragariastrum*, *Thymus serpyllum*, *Carduus palustris*, *Galium saxatile*, *Plantago lanceolata* and *Viola canina*. Professor R. J. Tabor found *Synchytrium* on *Saxifraga oppositifolia* from the same district. Examination of these seven hosts reveals great diversity of gall structure.

Potentilla Fragariastrum bears unicellular, globose galls projecting from the epidermis. Stems, leaves, petioles, stipules and calyx are galled. This form bears great resemblance to *Synchytrium Potentillae*. Summer sori and resting sporangia are produced.

Carduus palustris produces flat galls on its leaves. This form of *Synchytrium* possesses both summer sori and resting sporangia and resembles *S. Taraxaci*.

Thymus serpyllum bears hemispherical, multicellular galls on stems and leaves and occasionally on buds. This species is *Synchytrium aureum*.

Galium saxatile develops deformed buds due to infection of the meristems, although stems and leaves may also be galled. This species is *Synchytrium aureum* and possibly *S. aureum* var. *Galii*, although it is found growing with infected thyme.

Plantago lanceolata has unicellular galls which are embedded in the leaf and many contain resting sporangia or summer sori. No proliferation of cells takes place. The gall of *Viola canina* is multicellular. Present knowledge is insufficient to allow any attempt to classify these two forms.

In each of these forms the parasite is limited to a single epidermal cell.

R. Drummond. Notes on the Blackening of Apples caused by *Sclerotinia fructigena* and on the Wither-tip Disease of Plums caused by *Sclerotinia cinerea*.

I. *Blackening of apples*

Experiments were carried out at Cambridge during the early spring and summer of 1933 to ascertain whether the blackening of apples caused by *Sclerotinia fructigena* is due to a particular strain of that fungus or is merely dependent upon the degree of maturity of the fruit.

In March, apples were surface sterilised and cut in two with a scalpel; each half was then inoculated with a strain of *S. fructigena*, isolated either from a black rotted apple or from a brown rotted apple.

After four weeks, opposite halves of the same apples were similar in colour and appearance whether inoculated with the strain isolated from the black rotted apple or that isolated from the brown rotted apple. These mature fruits all showed nigrescence and formed few conidial pustules; young apples, however, inoculated in July by a similar method, became light brown and produced many buff-coloured conidial pustules.

On the other hand, apples inoculated with a strain of *S. cinerea* isolated from Morello cherry blossom blackened irrespective of either age or season.

The results of these experiments indicated that the age of the apple favours the development of the blackening caused by *S. fructigena*, fruits inoculated late in the season becoming black more rapidly.

II. *Wither-tip*

A series of experiments was carried out at Cambridge during the spring and summer of 1933 to find out in what manner young plum shoots become infected with wither-tip disease. An attempt was made to bring about artificial infection of punctured and unpunctured shoots by various methods; the presence of aphides as a factor necessary for infection was also taken into consideration.

A spore suspension was made with conidia of *S. cinerea* (forma *Pruni*) that were formed on sterilised potato slices in tubes. A drop of this liquid was transferred with a sterile brush to leaf laminae, nectary glands, nodes and the bark of young shoots.

In a first experiment, out of twenty inoculations carried out on Victoria plum trees growing in pots in a greenhouse, punctured young leaf laminae, nectary glands, nodes and bark of young stems all gave positive results. No satisfactory evidence of infection of unwounded tissues nor of mature leaf-laminae was obtained. These trees were not infested with aphides.

In a second experiment, three inoculations out of twenty carried out on Victoria, Early Rivers and Czar plum trees in the open were successful. The successful inoculations were one of an unpunctured nectary gland, one of an unpunctured leaf lamina and one of a punctured leaf lamina. These trees were infested with aphides.

In a third experiment, twenty plum shoots cut from Victoria trees in the open and kept in water in a greenhouse were inoculated. Inoculations of all tissues except those of mature leaf laminae were successful. Wounding was not necessary; all these shoots had been exposed to aphis attack in the open.

A fourth experiment was carried out on shoots which had not been infested with aphides, cut from Victoria plum trees growing in a greenhouse. Inoculations of unpunctured leaf laminae and nectary glands were seldom successful, but punctured tissues were easily infected.

These experiments indicated that infection of shoots on trees occurred through young punctured leaf laminae, glands and nodes in the absence of aphides, but that unwounded tissues were resistant. Unpunctured cut shoots that had been exposed to aphis attack showed symptoms of the disease when inoculated, but successful infections of leaves free from aphides rarely occurred.

Successful inoculations were obtained by placing drops of a spore suspension on the nectary glands, stem nodes and young leaf laminae. Mature leaves were resistant.

In the open, successful infections were difficult to obtain even when aphides abounded; this lack of success may have been due to the absence of favourable weather conditions. Moist weather favours wither-tip, and the spring and summer of 1933 were unusually hot and dry.

G. H. Pethybridge. Antirrhinum Rust and Asparagus Rust in England, 1933.

Puccinia Antirrhini *Diet. & Holw.*

Two rusts have come into prominence during the present year. The first one, that of Snapdragon (*Puccinia Antirrhini* Diet. & Holw.), had been known to occur previously only in the United States of America, Canada and Bermuda, where it causes much trouble. It was unexpectedly discovered in England in July 1933, by Mr D. E. Green, of Wisley, on Antirrhinums from Kent, and an illustrated note by him, calling attention to the occurrence, appeared in the *Gardeners' Chronicle*, xciv (1933), 131. This constitutes the first published record of this rust in Britain. Antirrhinum plants affected with the rust soon began to arrive at the Ministry's Plant Pathological Laboratory and, by the end of the summer, more than sixty outbreaks had come to light. Probably there were many others. The counties concerned were Norfolk, Suffolk, Essex, Herts, London, Kent, Surrey, Sussex, Hants, Oxon and Devon. Although this rust had not actually been recorded for this country before, enquiries showed that it may possibly have been here previously but not have been observed by any mycologist. A foreman gardener said he had seen it two years ago in Essex, whilst a gardener in Sussex said he had seen it eight or nine years previously. Another competent observer seems to have noticed it in the south of England in 1921, but did not disclose its presence. Strange to say, a specimen was received at the Pathological Laboratory from the north of France in August 1933, and the rust was also discovered soon afterwards near Paris. Hence its distribution now extends to the European continent as well as to Britain. The suggestion has been made that the rust was transmitted with imported seed, but American workers have obtained only negative results in seed transmission

experiments. The rust is heteroecious, but the alternate aecidial host has not yet been discovered; it is presumed to be some wild Californian plant. Overwintering in the uredo-stage has been proved to occur with plants kept from one season to the next.

Asparagus rust, Puccinia Asparagi *DC.*

No record of the occurrence of the second rust *Puccinia Asparagi* DC. in England or Wales has been received since the Ministry of Agriculture's Survey started in 1917. In the *Report* for 1920–1 it is stated to be "apparently almost extinct in England"; in that for 1925–7 it is said to be "fortunately absent here."

This last statement, even if true then, is certainly not so to-day, for a specimen of this rust was received at the Pathological Laboratory on September 30th, 1933, from Mr Ogilvie, Long Ashton, who had received it from Mr A. B. Thorn, Instructor in Horticulture, Ipswich; and this occurrence has stimulated further enquiry.

This rust was reported by Greville in 1824 as having been found near Edinburgh, and this appears to be the first record of it for the British Isles. It was included by Berkeley in Hooker's *British Flora* in 1836 and by Berkeley in his *Outlines of British Fungology* in 1860. The only British specimens of it in the British Museum and the Kew Herbarium came from Swanscombe, Kent (1865) and Ealing (1873). G. Abbey reported it as disastrous in 1895, in Cambs, South Lincs, Hunts, Norfolk, Cheshire and Worcs. Cooke listed it in 1871, and Plowright did so in 1889, whilst Grove (1913) gives it as "rather frequent." Carruthers referred to outbreaks in years just prior to 1897, but did not indicate the district. These are all the British records so far traced.

A discerning grower in the Evesham district informed Mr R. C. Gaut that asparagus rust crippled the growth there so much in 1904, 1905 and 1906 that scores of acres were ploughed up. Sir Rowland Biffen has kindly reported that he has specimens gathered by him in 1899 in Evesham and others, obtained in 1912, that probably came from Cottenham, Cambs. He also noted the rust in his own garden in Cambridge three or four years ago, and has occasionally seen the aecidial stage in recent years on bunches of asparagus in the Cambridge market, probably from Cottenham.

From enquiries made recently by Dr Dillon Weston and others it transpires that the rust has appeared in 1933 in the eastern counties in at least twenty-three localities, viz.: Norfolk—Woodbastwick, Brundall, Emneth and Stoke Ferry; Suffolk—Halesworth, Holton, Coddenham, Woodbridge, Yoxford, Sutton, Holesley and Ipswich; Cambridge—March, Shippea Hill, Isleham, Fordham, Cottenham, Waterbeach, Over, Linton, Shelford and Cambridge; Bedfordshire—Pertenhall. In some localities more than one outbreak has occurred. Diligent search in the west by Mr Mulligan has resulted in the discovery of one case only, viz. near Evesham. It would seem, therefore, that asparagus rust has probably never been extinct in this country, but has persisted for years, though its intensity has often been slight. On this account, and perhaps because little special search has been undertaken, the rust has passed unrecorded.

P. Asparagi was first described in 1815 by de Candolle, in France. It has also been recorded in Europe from Italy, Germany, Hungary, Austria, Sweden, Roumania, Holland, Denmark and Switzerland. It occurred in epidemic form in Germany as recently as 1930. It was reported in 1926 in South Africa, but not on cultivated asparagus. It was first definitely recorded in the U.S.A. (but perhaps doubtfully) in 1880, but its presence there was not clearly appreciated until 1896. Within a few years of this date it had already become devastating there. Its ravages have largely been prevented by the raising and use of highly resistant varieties. Good accounts of this rust and the means used in controlling it will be found in *California Agric. Exp. Station Bulletin*, Nos. 165 (1905) and 172 (1906), and *U.S. Dept. Agric. Bur. Pl. Indust. Bulletin*, No. 263 (1913) and Circular 7, C., T., and F. C. (1919).

REVIEW

Recent Advances in the Study of Plant Viruses. By KENNETH M. SMITH. With Foreword by F. T. BROOKS. Pp. xii+423, with coloured frontispiece and 67 text-figures. London: J. & A. Churchill. 1933. 15*s*.

The scientific investigation of disease caused by an infective ultra-microscopic principle dates from 1892 when Iwanowski showed that tobacco mosaic was caused by a filter-passing virus. A few years later it was found that foot-and-mouth disease in animals was also due to a filterable virus. Interest in such diseases was thus roused and knowledge regarding them began to accumulate.

In 1923, Dr E. J. Butler wrote on "Some Characteristics of the Virus Diseases of Plants" (*Science Progress*, No. 67, pp. 417–31), and it is interesting to compare his account with Dr Kenneth Smith's book. Comparatively little work had been carried out on plant virus diseases in this country ten years ago, and in Dr Butler's article there is no mention of plant virus work in Britain except a passing reference to leaf-roll in potato. However, as a result of a resolution passed at the Imperial Agricultural Conference in 1927 the investigation of these diseases received financial support and the response to the stimulus was soon evident. The various lists of references in the book show how prolific has been the output of information on plant viruses in this country and abroad during recent years; thus, in the "Literature on Physical Properties of Viruses," 120 of the 131 references are to papers published since 1923.

The work has progressed at such a rate that it must be difficult even for the specialist in virus diseases to keep in touch with the methods and results of other investigators in this field. For those whose work is more general, to follow the behaviour of the *X*, *Y*, and other alphabetically denoted viruses, used alone or in varied combinations, has been almost an impossibility, especially as the results are often published in journals not easily accessible. Dr Kenneth Smith has therefore rendered a great service to plant pathologists in general and to virus workers in particular by bringing together in one volume an account of these diseases and of the properties of the viruses causing them. Much of the recent work on plant viruses has been directed to a study of their physical and physiological characters, and of their mode of transmission; in this book are two chapters devoted to the *Physical Properties* of viruses, one to their *Physiology* and three to *Insects in Relation to Viruses*. The actual description of specific diseases occupies the last three chapters (about one-third of the whole book) and one of these deals solely with potato viruses. Most of the diseases receive brief though adequate treatment, but "Reversion" in black currants is given scant notice, with no description of symptoms, although it is an important disease, and one that has attracted considerable attention in this country.

In glancing through the references it will be seen that much of the recent work on virus diseases of plants has been carried out at agricultural research institutes. The ultimate object, then, is the control of these diseases or their elimination from important crop plants. It would seem, however, from a perusal of the book that little has been achieved in this direction as there is no discussion of control measures. Those who have a practical outlook would like to know to what end these investigations are leading and also what measure of success has attended the methods already in vogue for checking these diseases, in the way of "roguing" and the propagation from disease-free plants.

There are few misprints and those unimportant. The mode of treatment involves a certain amount of unavoidable repetition, but it seems unnecessary to repeat

(with but slight variation in wording) on pp. 281, 282 and 394 the statement on p. 275, "McWhorter considers that breaking [in tulips] is due to the interaction of two viruses. One of these viruses carries a colour-adding factor, etc."

An attempt has been made to bring the subject thoroughly up to date. The author has not only drawn on results published during the first half of the year of publication but in two instances he has been able to make use of unpublished work. The book marks an epoch in the study of plant viruses and will serve as a basis for further research. It will make an appeal to all who are interested in the pathological aspect of plant life. H. W.

LIST OF MEMBERS

Honorary Members

Lister, Miss Gulielma, F.L.S., 871, High Road, Leytonstone, Essex. (1903.) (1924.)

Rea, Mr Carleton, B.C.L., M.A., 6, Barbourne Terrace, Worcester. (1896.) (1918.)

Smith, Miss Annie Lorrain, F.L.S., 20, Talgarth Road, West Kensington, London, W. 14. (1899.) (1924.)

Ordinary Members

1. Aberdeen, The University Library. (1916.)
2. Adams, Rev. J. H., Landulph Rectory, Hatt, Saltash, Cornwall. (1919.)
3. Adcock, Mr Archie, Upton Road, Norwich. (1921.)
4. Ainsworth, Mr G. C., B.Sc., Experimental and Research Station, Cheshunt, Herts. (1931.)
5. Ainsworth, Mrs G. C., B.Sc., D.I.C., 13, Turner's Hill, Cheshunt, Herts. (1932.)
6. Alcock, Mrs N. L., F.L.S., Royal Botanic Gardens, Edinburgh. (1919.)
7. Arney, Mr S. E., Weacombe, Warren Lane, Aylesford, Kent. (1932.)
8. Ashby, Mr S. F., B.Sc., Imperial Mycological Institute, Ferry Lane, Kew, Surrey. (1926.)
9. Ashford, Dr Bailey K., Professor of Tropical Medicine and Mycology, University of Porto Rico, Box 887, San Juan, Porto Rico, W.I. (1929.)
10. Asthana, Mr R. P., Ph.D., M.Sc., D.I.C., F.L.S., c/o Mr Triloki Nath, District Judge, Meerut, U.P., India. (1932.)
11. Barnes, Mr B., D.Sc., Ph.D., F.L.S., Chelsea Polytechnic, London, S.W. 3. (1922.)
12. Barnett, Miss E. C., B.Sc., 48, Albury Road, Aberdeen. (1921.)
13. Barr, Rev. Robert, T.D., M.A., The Manse, Neilston, Renfrewshire. (1918.)
14. Barrington, Dr F. J. F., University College Hospital, Medical School, University Street, London, W.C. 1. (1901.)
15. Bartlett, Mr A. W., M.A., M.Sc., F.L.S., Department of Botany, Armstrong College, Newcastle-on-Tyne. (1920.)
16. Bates, Mr G. R., c/o British South Africa Company, Mazoe Citrus Estate, Mazoe, S. Rhodesia. (1930.)
17. Bates, Mrs L. F., B.Sc., 36, Gainsborough Gardens, Golders Green, London, N.W. 11. (1921.)
18. Beardslee, Mr H. C., Perry, Ohio, U.S.A. (1933.)

19. Beaumont, Mr Albert, M.A., Seale-Hayne Agricultural College, Newton Abbot, Devon. (1924.)
20. Bellchambers, Mr A., The Gardens, Eaton Hall, Chester. (1932.)
21. Bewley, Mr W. F., D.Sc., Experimental and Research Station, Cheshunt, Herts. (1922.)
22. Biffen, Professor Sir Rowland H., M.A., F.R.S., 136, Huntingdon Road, Cambridge. (1899.)
23. Biologist, Plant Research Laboratory, Horticultural Gardens, Burnley, Victoria, Australia. (1921.)
24. Birmingham Natural History and Philosophical Society, c/o G. T. Calvert, Esq., Hon. Librarian, Avebury House, 55, Newhall Street, Birmingham. (1920.)
25. Bisby, Mr Guy R., Ph.D., Manitoba Agricultural College, Winnipeg, Canada. (1921.)
26. Blackman, Professor V. H., M.A., F.R.S., Imperial College of Science, South Kensington, London, S.W. 7. (1900.)
27. Blackwell, Miss E. M., M.Sc., Botanical Department, Royal Holloway College, Englefield Green, Surrey. (1917.)
28. Blagden, Mr C. O., 46, Portland Road, Holland Park Avenue, London, W. 11. (1910.)
29. Bolas, Mr B. D., M.Sc., 20, Cambridge Gardens, Winchmore Hill, London, N. 21. (1924.)
30. Bonn, Germany, Institut für Pflanzenkrankheiten, Nuss-Allee 9. (1931.)
31. Borthwick, Professor A. W., O.B.E., D.Sc., Forestry Department, The University, Aberdeen. (1911.)
32. Boston, The Mycological Club, c/o Miss Jennie F. Conant, 26, Prospect Street, Melrose, Mass., U.S.A. (1906.)
33. Bradshaw, Mr F., M.A., D.Sc., Armstrong College, Newcastle-on-Tyne. (1928.)
34. Braid, Professor K. W., B.A., B.Sc., West of Scotland Agricultural College, 6, Blythswood Square, Glasgow. (1922.)
35. Brazier, Mr E., Ty'n-y-gongl, Love Lane, Stourbridge. (1921.)
36. Brenchley, Mr G. H., B.A., Clare College, Cambridge. (1925.)
37. Brett, Miss M., M.Sc., Northern Polytechnic, Holloway Road, London, N. 7. (1921.)
38. Briant, Mr A. K., B.A., Imperial College of Tropical Agriculture, St Augustine, Trinidad, B.W.I. (1927.)
39. Brierley, Professor W. B., D.Sc., F.R.A.I., F.L.S., Department of Agricultural Botany, The University, Reading. (1919.)
40. Brisbane, The Director, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, Queensland, Australia. (1930.)

41. British Museum, The Trustees of, Cromwell Road, South Kensington, London, S.W. 7. (1914.)
42. Briton-Jones, Professor H. R., D.Sc., Ph.D., D.I.C., A.R.C.S., Imperial College of Tropical Agriculture, St Augustine, Trinidad, B.W.I. (1923.)
43. Brooks, Mr F. T., M.A., F.R.S., F.L.S., The Botany School, Cambridge. (1907.)
44. Brown University, Library, East Side Station, Providence, R.I., U.S.A. (1920.)
45. Brown, Professor W., M.A., D.Sc., Imperial College of Science, South Kensington, London, S.W. 7. (1922.)
46. Bruxelles, Jardin Botanique de l'État, c/o M. P. van Aerdschot. (1911.)
47. Bryce, Mr G., D.Sc., Department of Agriculture, Ibadan, Nigeria, W. Africa. (1915.)
48. Buckley, Mr W. D., "Lynmouth," 2, Curzon Street, Slough. (1916.)
49. Buddin, Mr Walter, M.A., Laboratory of Plant Pathology, University of Reading, 7, Redlands Road, Reading. (1921.)
50. Buller, Professor A. H. R., D.Sc., Ph.D., F.R.S., University of Manitoba, Winnipeg, Canada. (1911.)
51. Bunting, Mr R. H., F.L.S., Imperial College of Science, Biological Field Station, "Hurworth," London Road, Slough. (1921.)
52. Burgess, Mr R., M.Sc., British Research Association for the Woollen and Worsted Industries, Torridon, Headingley, Leeds. (1928.)
53. Burr, Mr S., The Agricultural Department, The University, Leeds. (1924.)
54. Butcher, Mr R. W., B.Sc., Ph.D., F.L.S., Fisheries Research Station, Alresford, Hants. (1922.)
55. Butler, Mr E. J., C.I.E., C.M.G., D.Sc., M.B., F.R.S., F.L.S., Imperial Mycological Institute, Ferry Lane, Kew, Surrey. (1920.)
56. Cairns, Mr Hugh, M.Agr., B.Sc., The Queen's University, Belfast, N. Ireland. (1932.)
57. Caldwell, Mr J., B.Sc., Ph.D., Rothamsted Experimental Station, Harpenden, Herts. (1932.)
58. Cambridge, The Botany School. (1920.)
59. Campbell, Mr A. H., B.Sc., Ph.D., Department of Botany, The University, Bristol. (1934.)
60. Carne, Mr W. M., F.L.S., Department of Agriculture, Hobart, Tasmania, Australia. (1928.)
61. Carr, Professor J. W., M.A., F.L.S., Mapperley Edge, Private Road, Sherwood, Nottingham. (1896.)

62. Carrothers, Mr E. N., 145, Stranmillis Road, Belfast, N. Ireland. (1925.)
63. Carter, Miss F. M., Ph.D., Botanical Department, The University, Edgbaston, Birmingham, 15. (1934.)
64. Cartwright, Mr K. St G., B.A., F.L.S., The Red House, Kingston Blount, Oxford. (1913.)
65. Castellani, Sir Aldo, M.D., 23, Harley Street, London, W. 1. (1922.)
66. Cayley, Miss Dorothy M., John Innes Horticultural Institute, Mostyn Road, Merton, Surrey. (1913.)
67. Charles, Miss Vera K., United States Department of Agriculture, Bureau of Plant Industry, Washington D.C., U.S.A. (1933.)
68. Chaudhuri, Mr H., M.Sc., Ph.D., University of the Punjab, Lahore, India. (1920.)
69. Cheal, Mr W. F., Gosmoor Lane, Elm, nr Wisbech, Cambs. (1927.)
70. Cheel, Mr Edwin, Botanic Gardens, Sydney, New South Wales, Australia. (1919.)
71. Chesters, Mr C. G. C., Botanical Department, The University, Edgbaston, Birmingham. (1930.)
72. Chona, Mr B. L., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1929.)
73. Ciferri, Professor Dr R., Assistant Director, Laboratorio Crittogamico, Casella Postale 165, Pavia, Italy. (1926.)
74. Clapham, Mr A. R., M.A., Ph.D., Department of Botany, The University, Oxford. (1931.)
75. Cleland, Mr J. Burton, M.D., Professor of Pathology, University of Adelaide, South Australia. (1918.)
76. Clouston, Mr D., M.A., B.Sc. (Agr.), North of Scotland College of Agriculture, Crown Mansions, 41, Union Street (2nd Floor), Aberdeen. (1931.)
77. Connecticut Agricultural Experiment Station, New Haven, Connecticut, U.S.A. (1929.)
78. Cook, Mr W. R. I., B.Sc., Ph.D., Department of Botany, University College, Newport Road, Cardiff. (1924.)
79. Cooke, Mr G. J., 143, Newmarket Road, Norwich. (1933.)
80. Cooper, Miss Charlotte A., California Lane, Bushey Heath, Herts. (1911.)
81. Cooper, Mrs V. Astley, Clerdoun, Epsom Road, Ewell, Surrey. (1921.)
82. Cornell University, The Library, New York State College of Agriculture, Ithaca, N.Y., U.S.A. (1920.)
83. Corner, Mr E. J. H., B.A., F.L.S., Assistant Director, Botanic Garden, Singapore, Straits Settlements. (1924.)

84. Cotton, Mr Arthur D., F.L.S., Keeper, Herbarium, Royal Botanic Gardens, Kew, Surrey. (1902.)
85. Cunningham, Mr G. H., Ph.D., Plant Research Station, Box 240, Palmerston North, New Zealand. (1922.)
86. Curtis, Miss Kathleen M., M.A., D.Sc., D.I.C., F.L.S., Mycologist, Biological Department, Cawthron Institute of Scientific Research, Nelson, New Zealand. (1917.)
87. Cutting, Mr E. M., M.A., F.L.S., Botanical Department, University College, Gower Street, London, W.C. 1. (1920.)
88. Dade, Mr H. A., A.R.C.S., Department of Agriculture, Aburi, Gold Coast, West Africa. (1927.)
89. Darbishire, Professor O. V., B.A., Ph.D., F.L.S., The University, Bristol. (1913.)
90. Das, Mr Kedarnath, C.I.E., M.D., Principal, Carmichael Medical College, 1, Belgachia Road, Calcutta, India. (1922.)
91. Davies, Mr D. W., B.Sc., Adviser in Mycology, Agricultural Buildings, University College of Wales, Aberystwyth. (1923.)
92. Davis, Mr J. Jefferson, B.S., M.D., University of Wisconsin, Madison, Wis., U.S.A. (1921.)
93. Day, Mr E. Metcalfe, Rowan Cottage, Minchinhampton, Glos. (1921.)
94. Day, Mr W. R., B.A., B.Sc., Imperial Forestry Institute, Oxford. (1928.)
95. Deacon, Dr G. E., Brundall, Norwich. (1933.)
96. Dehra Dun, The Forest Botanist, Forest Research Institute and College, U.P., India. (1929.)
97. Deighton, Mr F. C., M.A., Mycologist, Department of Lands and Forests, Freetown, Sierra Leone, West Africa. (1925.)
98. Dennis, Mr R. W. G., West of Scotland Agricultural College, 6, Blythswood Square, Glasgow. (1932.)
99. Dickinson, Mr S., School of Agriculture, Cambridge. (1921.)
100. Dickson, Mr B. T., B.A., Ph.D., Senior Mycologist, Council for Scientific and Industrial Research, 314, Albert Street, East Melbourne, Australia. (1923.)
101. Dobbs, Mr C. G., 12, Colinette Road, Putney, London, S.W. 15. (1933.)
102. Dobinson, Mr H., 166, Piccadilly, London, W. 1. (1932.)
103. Dodge, Dr Carroll W., Missouri Botanical Garden, 2315, Tower Grove Avenue, St Louis, Missouri, U.S.A. (1926.)
104. Dowson, Mr W. J., M.A., D.Sc., The Botany School, Cambridge. (1920.)
105. Duncan, Mr J. T., London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C. 1. (1930.)

106. Edwards, Mr W. H., Belle Vue, Barline, Beer, Devon. (1896.)
107. Elliott, Mr W. T., D.D.S., L.D.S., F.L.S., F.Z.S., Arden Grange, Tanworth-in-Arden, Warwickshire. (1913.)
108. Elliott, Mrs J. S. Bayliss, D.Sc. (B'ham), B.Sc. (Lond.), Arden Grange, Tanworth-in-Arden, Warwickshire. (1911.)
109. Ellis, Mr E. H., B.Sc., Department of Botany, British Museum (Nat. Hist.), Cromwell Road, London, S.W. 7. (1924.)
110. Ellis, Miss E. M., St Hugh's College, Oxford. (1930.)
111. Ellis, Mr Holmes, F.R.M.S., 108, Birtwistle Avenue, Colne, Lancs. (1927.)
112. Emoto, Dr Y., Biological Department, Peers' College (Sakushuin), Takata-Machi, Tokyo, Japan. (1929.)
113. Engledow, Professor F. L., M.A., School of Agriculture, Cambridge. (1922.)
114. Essex Field Club, c/o Mr Percy Thompson, F.L.S., Essex Museum of Natural History, Romford Road, Stratford, London, E. 15. (1919.)
115. Eweis, Mr E. M., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1932.)
116. Exeter, Librarian, University College of the South-West of England. (1926.)
117. Eyre, Miss J. C., c/o Miss Wakefield, Herbarium, Royal Botanic Gardens, Kew. (1915.)
118. Faulkner, Mr F., c/o Gillanders, Arbuthnot & Co., Bombay, India. (1930.)
119. Fenton, Mr E. W., M.A., B.Sc., F.L.S., Biology Department, Edinburgh and East of Scotland College of Agriculture, Edinburgh. (1920.)
120. Findlay, Mr W. P., B.Sc., A.R.C.S., Courte Falaise, Sevenoaks, Kent. (1928.)
121. Finlayson, Mr Raymond A., F.L.S., Official Seed Testing Station, Huntingdon Road, Cambridge. (1910.)
122. Fisher, Mr S. D. P., Sackville Street, Leeds. (1930.)
123. Forwood, Mr R., Wynfield, Parkgate, Cheshire. (1930.)
124. Gadd, Mr C. H., D.Sc., Tea Research Institute, Nuwara Eliya, Ceylon. (1921.)
125. Galloway, Mr L. D., 2, Milton Crescent, Cheadle, Cheshire. (1928.)
126. Gardner, Capt. Frederic, c/o Barclays Bank, Jersey, C.I. (1898.)
127. Garside, Mr S., M.Sc., F.L.S., Botanical Department, Bedford College, Regent's Park, London, N.W. 1. (1922.)
128. Gates, Professor R. R., B.Sc., Ph.D., F.R.S., F.L.S., King's College, Strand, London, W.C. 2. (1921.)
129. Gäumann, Dr E. A., Prof. f. spezielle Botanik, Universitätsstrasse 2, Zürich 6, Switzerland. (1928.)

130. Ghamrawy, Mr Ali K., 39, Monirah Street, Cairo, Egypt. (1932.)
131. Gibson, Miss C. J., B.A., 27, Banbury Road, Oxford. (1933.)
132. Gilbert, Dr E. M., Botanical Department, University of Wisconsin, Madison, Wis., U.S.A. (1922.)
133. Gilbert, M. E., Docteur en Pharmacie, 6, Rue de Laos, Paris (15^{e}), France. (1924.)
134. Gisborne, Mr J. H., Keble College, Oxford. (1932.)
135. Glasstone, Mrs V. F. C., B.A. (Oxon.), 15, Northumberland Road, Sheffield. (1930.)
136. Glynne, Miss Mary D., M.Sc., F.L.S., Rothamsted Experimental Station, Harpenden, Herts. (1932.)
137. Gorman, Mr M. J., A.R.C.Sc.I., Albert Agricultural College, Glasnevin, Dublin. (1925.)
138. Gough, Mr G. C., B.Sc., A.R.C.S., Ministry of Agriculture, Cornwall Buildings, 45, Newhall Street, Birmingham. (1923.)
139. Gould, Mr F. G., Woodrising, Trapps Hill, Loughton, Essex. (1918.)
140. Green, Col. C. Theodore, A.M.S., M.R.C.S., L.R.C.P., F.L.S., 31, Shrewsbury Road, Birkenhead. (1901.)
141. Green, Miss E., M.Sc., 15, Gower Street, London, W.C. 1. (1925.)
142. Green, Miss F. Mary, The Botany School, Cambridge. (1931.)
143. Gregor, Mrs M. J. F., Ph.D., Royal Botanic Garden, Edinburgh. (1927.)
144. Gregory, Mr P. H., Ph.D., Gordon Bell Research Laboratory, Medical College, University of Manitoba, Winnipeg, Canada. (1930.)
145. Grieve, Mr B. J., M.Sc., Botanical Department, Melbourne University, Carlton, Victoria, Australia. (1931.)
146. Grinling, Mr C. H., B.A., 71, Rectory Place, Woolwich, London, S.E. 18. (1913.)
147. Grove, Miss Jessica H., 14, The Tything, Worcester. (1927.)
148. Gwynne-Vaughan, Professor Dame Helen, G.B.E., D.Sc., LL.D., F.L.S., 93, Bedford Court Mansions, London, W.C. 1. (1906.)
149. Hall, Miss M. P., Plant Pathology Department, Imperial College of Science, South Kensington, London, S.W. 7. (1930.)
150. Hanna, Mr W. F., M.Sc., Dominion Rust Research Laboratory, Agricultural College, Winnipeg, Canada. (1925.)
151. Hansford, Mr C. G., M.A., F.L.S., Mycologist, Department of Agriculture, Kampala, Uganda. (1921.)
152. Harley, Mr J. L., 18, Oak Road, Newton Park, Leeds. (1932.)

153. Harris, Mr R. V., B.Sc., Horticultural Research Station, East Malling, Kent. (1924.)
154. Harrison, Mr T. H., B.Sc. (Agr.), Hawkesbury Agricultural College, Richmond, N.S. Wales, Australia. (1931.)
155. Harvard University, The Library, Cambridge, Mass., U.S.A. (1923.)
156. Hastings, Mr Somerville, M.S., F.R.C.S., 43, Devonshire Street, Portland Place, London, W. 1. (1913.)
157. Heim, M. Roger, Sous-Directeur au Muséum d'Histoire Naturelle, 11, Rue de Medicis, Paris (VIe), France. (1930.)
158. Heimbeck, Mrs Louise, Brosoe, Levanger, Norway. (1923.)
159. Hemmi, Dr Takewo, Phytopathological Institute, Department of Agriculture, Kyoto Imperial University, Kyoto, Japan. (1923.)
160. Hereford, Mr E. H., 131, Queen Victoria Street, London, E.C. 4. (1933.)
161. Hildyard, Mr F. W., 1, Lichfield Road, Kew, Surrey. (1913.)
162. Hiura, Professor Makoto, Gifu Imperial College of Agriculture, Naka-Mura, Gifu, Japan. (1931.)
163. Holden, Professor H. S., D.Sc., F.L.S., Botanical Department, University College, Nottingham. (1923.)
164. Honolulu, Association of Hawaiian Pineapple Canners, P.O. Box 3166, Hawaii. (1929.)
165. Honolulu, The Library, Experimental Station, S.P.A., Box 411, Hawaii. (1920.)
166. Hopkins, Mr J. C. F., Agricultural Department, Salisbury, S. Rhodesia. (1930.)
167. Horne, Mr A. S., D.Sc., F.L.S., F.G.S., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1921.)
168. Howard, Mr H. J., F.R.M.S., F.L.S., "Lingfield," 6, College Road, Norwich. (1918.)
169. Hubbard, Miss M. D., Department of Botany, University College of Wales, Aberystwyth. (1933.)
170. Hughes, Mr G. C., Chesterton, Bicester, Oxon. (1898.)
171. Hughes, Mr J. S., M.A., University Observatory, Oxford. (1927.)
172. Hull, The Librarian, Botanical Department, University College. (1929.)
173. Humphrey, Mr C. J., Mycologist and Plant Pathologist, Bureau of Science, Manila, Philippine Islands. (1921.)
174. Hurrell, Mr H. E., 60, Albany Road, Great Yarmouth. (1921.)
175. Hurst, Mr C. P., Landulph Rectory, Saltash, Cornwall. (1928.)
176. Imperial College of Tropical Agriculture, Trinidad, B.W.I. (1921.)

177. Iowa, The Library, State University of Iowa, Library Annex, Iowa City, U.S.A. (1923.)
178. Iowa State College, Library, Ames, Iowa, U.S.A. (1927.)
179. Issatchenko, Professor B. L., Directeur du Jardin Botanique, Leningrad, Russia. (1923.)
180. John Crerar Library, 86, East Randolph Street, Chicago, Illinois, U.S.A. (1929.)
181. John Innes Horticultural Institute, Mostyn Road, Merton, Surrey. (1924.)
182. Johnson, Mr J. W. Haigh, M.Sc., F.I.C., F.L.S., Walton, nr Wakefield. (1919.)
183. Johnstone, Mr R. B., 3, Oswald Gardens, Scotstounhill, Glasgow. (1908.)
184. Jones, Mr G. H., M.A., Plant Protection Section, Ministry of Agriculture, Cairo, Egypt. (1922.)
185. Jørstad, Mr Ivar, Statsmykolog, Botanisk Museum, Oslo, Norway. (1923.)
186. Keissler, Dr Karl, Direktor d. Botanischen Abteilung, Naturhistorisches Museum, Burgring 7, Wien 1/1, Austria. (1924.)
187. Kelly, Dr Howard A., 1418, Eutaw Place, Baltimore, Md., U.S.A. (1921.)
188. Kent, Mr G. C., Botany Department, Iowa State College, Ames, Iowa, U.S.A. (1932.)
189. Klika, Mr Bohumil, Hálkova 37, Prague, Vrsovice 553, Czechoslovakia. (1926.)
190. Knight, Mr H. H., M.A., The Lodge, All Saints' Villas, Cheltenham. (1914.)
191. Kuala Lumpur, F.M.S., The Director of Agriculture, Straits Settlements, and Federated Malay States. (1930.)
192. Lampitt, Mr L. H., D.Sc., F.I.C., Thornlea, Mount Park, Harrow, Middlesex. (1925.)
193. Leach, Mr R., B.A., Agricultural Department, Mlanje, Nyasaland. (1929.)
194. Leicester, The Museum, City of Leicester. (1923.)
195. Lewis, Professor F. J., D.Sc., F.L.S., University of Alberta, Edmonton, Alberta, Canada. (1924.)
196. Line, Mr James, M.A., School of Agriculture, Cambridge. (1921.)
197. Linnean Society, The, Burlington House, Piccadilly, London, W. 1. (1919.)
198. Lloyd Library, The, Cincinnati, Ohio, U.S.A. (1907.)
199. Loader, Miss F. M., Botanical Department, University College, Southampton. (1927.)
200. Lowndes, Mr A. G., M.A., F.L.S., Marlborough College, Marlborough, Wilts. (1922.)

201. Lütjeharms, Mr W. J., Assistent aan's Rijks Herbarium, Leiden, Holland. (1930.)
202. McDonald, Mr J., D.F.C., B.Sc., F.L.S., Mycologist, Department of Agriculture, Box 323, Nairobi, Kenya Colony, East Africa. (1923.)
203. Macdonald, Mr J., 25, Drumsheugh Gardens, Edinburgh. (1929.)
204. McFarland, Dr Frank T., Department of Botany, University of Kentucky, Lexington, Ky., U.S.A. (1924.)
205. Mackenzie, Miss A. D., Research Station, East Malling, Kent. (1921.)
206. McLennan, Dr Ethel I., Botanical Department, Melbourne University, Carlton, Victoria, Australia. (1926.)
207. Madras University Library, Senate House, Triplicane, Madras, South India. (1925.)
208. Maire, M. René, D.Sc., F.M.L.S., Professeur à la Faculté des Sciences de l'Université, Algiers, Algeria, N. Africa. (1907.)
209. Marsh, Mr R. W., M.A., Research Station, Long Ashton, Bristol. (1923.)
210. Martyn, Mr E. B., B.A., Department of Agriculture, Georgetown, British Guiana. (1927.)
211. Masefield, Mr G. B., Lee Cottage, Charlbury, Oxon. (1932.)
212. Mason, Mr E. W., M.A., M.Sc., F.L.S., Imperial Bureau of Mycology, 17, Kew Green, Kew, Surrey. (1921.)
213. Mason, Mrs E. W., Inglenook, 63, King's Road, Richmond, Surrey. (1922.)
214. Mason, Mr F. A., F.R.M.S., M.S.P.A., 29, Frankland Terrace, Leeds. (1912.)
215. Matthews, Professor J. R., M.A., F.L.S., Botanical Department, The University, Reading. (1921.)
216. Mehta, Professor K. C., Ph.D., Department of Biology, Agra College, Agra, U.P., India. (1921.)
217. Melville, Mr R., 369, Church Street, Edmonton, London, N. 9. (1933.)
218. Metcalfe, Mr C. R., B.A., Ph.D., Jodrell Laboratory, Royal Botanic Gardens, Kew, Surrey. (1926.)
219. Meulenhoff, Dr J. S., Ruychrocklaan 30, The Hague, Holland. (1921.)
220. Michigan Agricultural College Library, East Lansing, Michigan, U.S.A. (1924.)
221. Miller, Professor J. H., B.S., M.S., Ph.D., University of Georgia, Athens, Ga., U.S.A. (1930.)
222. Missouri, The Botanical Garden, St Louis, Mo., U.S.A. (1902.)

223. Mitra, Mr M., M.Sc., Agricultural Research Institute, Pusa, Bihar and Orissa, India. (1928.)
224. Miyabe, Dr Kingo, Professor Emeritus of Botany, Hokkaido Imperial University, Sapporo, Japan. (1919.)
225. Montague, Mrs A., Penton, Crediton, N. Devon. (1898.)
226. Montana Experiment Station, Department of Botany and Bacteriology, Bozeman, Montana, U.S.A. (1930.)
227. Montreal, Canada, Faculté des Sciences, Institut Botanique, Université de Montréal. (1932.)
228. Moore, Mr W. C., M.A., Ministry of Agriculture, Pathological Laboratory, Milton Road, Harpenden, Herts. (1922.)
229. Morgan, Dr G., Ashley-Hatton, Dyke Road Avenue, Brighton. (1928.)
230. Morris, Mr L. E., 15, Tenison Avenue, Cambridge. (1924.)
231. Muller, Dr H. R. A., Institut voor Plantenziekten, Buitenzorg, Java. (1932.)
232. Murphy, Professor P. A., Sc.D., A.R.C.Sc.I., M.R.I.A., Department of Plant Pathology, Albert Agricultural College, Glasnevin, Dublin, N.W. 3. (1924.)
233. Murray, Mr G. H., F.E.S., Director of Agriculture, Rabaul, New Britain, Territory of New Guinea, *via* Australia. (1921.)
234. Muskett, Mr A. E., M.Sc., A.R.C.S., Queen's University, Belfast, Northern Ireland. (1923.)
235. Nannfeldt, Dr J. A., Sturegatan 11, Uppsala, Sweden. (1932.)
236. National Collection of Type Cultures, Curator, Lister Institute, Chelsea Gardens, London, S.W. 1. (1921.)
237. National Museum of Wales, Cardiff. (1924.)
238. Nattrass, Mr R. M., B.Sc. (Agric.), Ph.D., Department of Agriculture, Nicosia, Cyprus. (1925.)
239. Nebraska, The Library, University of, Lincoln, Nebr., U.S.A. (1924.)
240. Nederlandsche Mycologische Vereeniging, c/o Mr A. C. S. Schweers, Nassaulaan 17, Alkmaar, Holland. (1920.)
241. Nelson, Miss M. G., M.A., Botanical Department, The University, Oxford. (1932.)
242. New York Botanical Garden, Bronx Park, New York, U.S.A. (1904.)
243. Nicholson, Mr W. E., F.L.S., 50, St Anne's Crescent, Lewes. (1913.)
244. Noel, Miss E. F., F.L.S., 37, Burnham Court, Queen's Road, London, W. 2. (1913.)
245. Norman, Mr L. Stafford, Konjeni Estate, Luchenza P.O., Nyasaland. (1927.)

246. North Carolina, Library, University of, Chapel Hill, North Carolina, U.S.A. (1920.)
247. Nursery and Market Garden Industries' Development Society, Ltd., Experimental and Research Station, Cheshunt, Herts. (1922.)
248. Oberlin College, Oberlin, Ohio, U.S.A., Library, Department of Botany. (1933.)
249. O'Connor, Mr P., Ph.D., B.Sc., A.R.C.Sc.I., National Museum, Dublin. (1925.)
250. Ogilvie, Mr L., M.A., M.Sc., Research Station, Long Ashton, nr Bristol. (1922.)
251. Oke, Mr Alfred William, B.A., F.G.S., F.L.S., 32, Denmark Road, Hove, Sussex. (1908.)
252. Ontario Agricultural College, Library, Guelph, Ontario, Canada. (1920.)
253. Osborn, Professor T. G. B., D.Sc., F.L.S., Botanical Department, The University, Sydney, N.S.W., Australia. (1910.)
254. Ottawa, Ontario, Canada, The Library, Geological Survey. (1926.)
255. Overholts, Dr L. O., Botany Department, Pennsylvania State College, Pa., U.S.A. (1929.)
256. Page, Miss W. M., M.Sc., 19, Ledam Buildings, Bourne Estate, Holborn, London, E.C. 1. (1921.)
257. Park, Mr M., Department of Agriculture, Peradeniya, Ceylon. (1929.)
258. Parke Davis & Co., Medical Research Library, P.O. Box 488, Detroit, Michigan, U.S.A. (1920.)
259. Parker, Professor C. S., Department of Botany, Howard University, Washington, D.C., U.S.A. (1932.)
260. Paulson, Mr Robert, F.L.S., F.R.M.S., Glenroy, Cecil Park, Pinner, Middlesex. (1918.)
261. Pearson, Mr Arthur A., F.L.S., 59, Southwark Street, London, S.E. 1. (1911.)
262. Peklo, Dr Jaroslav, Professor of Applied Botany, Bohemian Technical University, Charles Square, Prague II, Czechoslovakia. (1924.)
263. Perthshire Society of Natural Science, c/o Mr James Winter (Hon. Treasurer), 35, George Street, Perth. (1919.)
264. Petch, Mr T., B.A., B.Sc., North Wootton, King's Lynn, Norfolk. (1911.)
265. Pethybridge, Mr G. H., Ph.D., B.Sc., F.L.S., Ministry of Agriculture, Pathological Laboratory, Milton Road, Harpenden, Herts. (1919.)
266. Peyronel, Dr Benjamino, R. Istituto Sup. Agrario e Forestale, Piazzale del Re, Firenze, Italy. (1932.)

267. Philadelphia, The Academy of Natural Sciences of Philadelphia, Logan Square, Phil., U.S.A. (1925.)
268. Phillips, Dr H. H., 6, St John's Road, Penge, London, S.E. 10. (1923.)
269. Ping, Mr A. Wentworth, M.A., "St Olave's," Clifton, York. (1926.)
270. Plowright, Mr C. T. M., B.A., M.B., Darnick, Flore, Northampton. (1901.)
271. Potter, Rev. M. C., Sc.D., M.A., F.L.S., Corley Croft, New Milton, Hants. (1896.)
272. Preston, Mr N. C., B.Sc., Harper Adams Agricultural College, Newport, Salop. (1920.)
273. Pretoria, South Africa, The Chief, Division of Botany (91403), Department of Agriculture. (1922.)
274. Purdue University, Library, Agricultural Experiment Station, Lafayette, Ind., U.S.A. (1931.)
275. Pusa, Imperial Mycologist, Imperial Agricultural Research Institute, Pusa, Bihar, India. (1921.)
276. Ramsbottom, Mr J., O.B.E., M.A., F.L.S., British Museum (Nat. Hist.), Cromwell Road, South Kensington, London, S.W. 7. (1910.)
277. Ray, Miss Anne, Penarwyn, Gorran Haven, Gorran, Cornwall. (1929.)
278. Rayner, Dr M. Cheveley (Mrs Neilson Jones), Bedford College for Women, Regent's Park, London, N.W. 1. (1921.)
279. Rea, Miss M. W., M.Sc., Salem House, Sydenham, Belfast, Northern Ireland. (1920.)
280. Rees, Mr John, M.Sc., Adviser in Agricultural Botany, University College, Cardiff. (1929.)
281. Reichert, Dr Israel, Jewish Agency for Palestine, Agricultural Experiment Station, P.O.B. 15, Rehoboth, Palestine. (1924.)
282. Rhind, Mr Donald, B.Sc., Economic Botanist, Department of Agriculture, Agricultural College, Mandalay, Burma. (1922.)
283. Rhodes, Miss Mabel, Lister Institute, Chelsea Gardens, London, S.W. 1. (1921.)
284. Rhodes, Rev. P. G. M., D.D., M.A. (Cantab.), F.L.S., St Mary's, Evesham, Worcestershire. (1929.)
285. Robson, Mr R., M.Sc., F.Z.S., East Hanningfield, Chelmsford, Essex. (1914.)
286. Roper, Miss Ida M., F.L.S., "The Curatage," 176, Chessell Street, Ashton Gate, Bristol 3. (1921.)
287. Rothamsted Experimental Station, Department of Mycology, Harpenden, Herts. (1923.)
288. Rutgers College and State University of New Jersey, Library, New Brunswick, New Jersey, U.S.A. (1922.)

289. St Paul, Minnesota, U.S.A., The Library, Department of Agriculture, University Farm. (1920.)
290. Salam, Mr M. M. Abdel-, Cotton Research Board, Giza, Egypt. (1930.)
291. Salisbury, Professor E. J., D.Sc., F.L.S., Botanical Department, University College, Gower Street, London, W.C. 1. (1921.)
292. Salmon, Professor E. S., F.L.S., South-Eastern Agricultural College, Wye, Kent. (1922.)
293. Sampson, Miss K., M.Sc., University College, Aberystwyth, North Wales. (1920.)
294. Samuel, Mr Geoffrey, The University of Adelaide, South Australia. (1923.)
295. Scott, Mr W. W., 13, Bishop's Road, Highgate, London, N. 6. (1922.)
296. Searle, Mr G. Odell, B.Sc. (Agric.), Research Botanist, Linen Industry Research Association, Glenmore House, Lambeg, Lisburn, Northern Ireland. (1920.)
297. Seth, Mr N. L., B.Sc., Ph.D., D.I.C., Agricultural College, Mandalay, Burma. (1930.)
298. Sharples, Mr A., A.R.C.S., D.I.C., Mycologist, Department of Agriculture, Kuala Lumpur, Federated Malay States. (1924.)
299. Shaw, Mr F. J. F., D.Sc., A.R.C.S., F.L.S., Imperial Agricultural Research Institute, Pusa, Bihar, India. (1920.)
300. Shear, Dr C. L., U.S. Department of Agriculture, Bureau of Plant Industry, Washington, D.C., U.S.A. (1930.)
301. Small, Mr W., M.B.E., M.A., Ph.D., B.Sc., Director, Department of Agriculture, Zomba, Nyasaland. (1915.)
302. Smart, Miss V., 69, High Street, Littlehampton, Sussex. (1929.)
303. Smith, Mr Alexander, M.A., Ph.D., Ministry of Agriculture, Pathological Laboratory, Milton Road, Harpenden, Herts. (1924.)
304. Smith, Miss K. E., The Quarry, Lutterworth Road, Nuneaton. (1913.)
305. Smith, Professor Noel J. G., Ph.D., B.Sc., Botany Department, Rhodes University College, Grahamstown, S. Africa. (1924.)
306. Smith, Mr Rupert, 38, Greenhill Gardens, Edinburgh. (1927.)
307. South London Botanical Institute, 323, Norwood Road, Tulse Hill, London, S.E. 24. (1921.)
308. Stakman, Professor E. C., University of Minnesota, Department of Agriculture, University Farm, St Paul, Minn., U.S.A. (1922.)
309. Statham, Miss E. M., 2, Westbrook Road, Blackheath, London, S.E. 3. (1926.)

310. Stationery Office, H.M., Superintendent of Publications, Book Dept., Westminster, S.W. 1. (4 subscriptions.) (1920.)
311. Stephens, Miss E. L., B.A., Department of Botany, University of Cape Town, Cape Town, South Africa. (1928.)
312. Stephens, Miss F. L., M.Sc., Department of Botany, British Museum (Natural History), Cromwell Road, South Kensington, London, S.W. 7. (1930.)
313. Steyaert, M. R. L., Station de Sélection Cotonnière de Bambesa, District des Uélés, Belgian Congo. (1931.)
314. Stirrup, Mr H. H., M.Sc., Midland Agricultural College, Sutton Bonington, Loughborough. (1922.)
315. Storey, Mr H. H., M.A., Ph.D., East African Agricultural Research Institute, Amani, Tanganyika Territory, East Africa. (1922.)
316. Sutherland, Mr G. K., M.A., D.Sc., F.L.S., "Bremhill," 21, Combe Park, Bath, Somerset. (1914.)
317. Swansea Field Naturalists' Society, c/o Mr E. R. Brown, 71, Rhyddings Park Road, Swansea, South Wales. (1924.)
318. Swanton, Mr E. W., A.L.S., Educational Museum, Haslemere, Surrey. (1899.)
319. Swedish Academy of Sciences, Royal, Stockholm, Sweden. (1919.)
320. Sydney, Australia, The Librarian, University of. (1922.)
321. Sydow, Herr H., Luitpoldstrasse 33, Berlin, W. 30, Germany. (1931.)
322. Tabor, Mr R. J., B.Sc., F.L.S., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1914.)
323. Taylor, Miss B. K., 98, Cheyne Walk, Chelsea, London, S.W. 3. (1910.)
324. Taylor, Mr J. C., B.Sc., B.Agr., Department of Agricultural Botany, Queen's College, Belfast, N. Ireland. (1933.)
325. Telfer, Mr R. Allsop, 7, Christchurch Road, Worcester. (1931.)
326. Tennessee, University of, Agricultural Experiment Station, Library, Knoxville, Tennessee, U.S.A. (1926.)
327. Tervet, Mr I. W., B.Sc., Botany Department, The University, Glasgow. (1933.)
328. Tetley, Miss U., Leyfield, Kirkby Lonsdale, Westmorland. (1929.)
329. Tomkins, Mr R. G., M.A., Ph.D., Trinity College, Cambridge. (1925.)
330. Tunstall, Mr A. C., Tocklai Experimental Station, Cinnamara P.O., Assam, British India. (1933.)

331. United States Department of Agriculture, c/o Wheldon and Wesley, 2–4 Arthur Street, New Oxford Street, London, W.C. 2. (1907.)
332. Vaheeduddin Ayed, Pathological Assistant, H.E.H. the Nizam's Agricultural Department, Hyderabad, Deccan, India. (1934.)
333. Vanterpool, Mr T. C., M.Sc., Botanical Department, University of Saskatchewan, Saskatoon, Canada. (1929.)
334. Vasudeva, Mr R. S., Cotton Pathologist, Agricultural College, Lyallpur, Punjab, India. (1929.)
335. Wadham, Professor S. M., M.A., Department of Agriculture, The University, Melbourne, Victoria, Australia. (1922.)
336. Wakefield, Miss E. M., M.A., F.L.S., Herbarium, Royal Botanic Gardens, Kew. (1911.)
337. Waldie, Mr J. S. L., B.Sc., C.D.A., Department of Agricultural Botany, The University, Reading. (1925.)
338. Wales, University College of, Librarian, Botanical Department, Aberystwyth, North Wales. (1927.)
339. Wallace, Mr G. B., B.Sc. (Agric.), Ph.D., Department of Agriculture, Morogoro, Tanganyika Territory, East Africa. (1928.)
340. Wallace, Mrs G. B., B.Sc., Morogoro, Tanganyika Territory, East Africa. (1924.)
341. Wallis, Mr A., Westacre, Station Road, Kettering. (1921.)
342. Ware, Mr W. M., M.Sc., South-Eastern Agricultural College, Wye, Kent. (1924.)
343. Watson, Mr W., D.Sc., A.L.S., Cedene, Cheddon Road, Taunton. (1933.)
344. Welsmann, Dr Ludwig, Pelkum, bei Hemm, Westphalia, Germany. (1932.)
345. Westerdijk, Professor Johanna, Javalaan 4, Baarn, Holland. (1923.)
346. Weston, Mr W. A. R. Dillon, M.A., School of Agriculture, Cambridge. (1923.)
347. Whetzel, Professor H. H., M.A., New York State College of Agriculture, Cornell University, Ithaca, N.Y., U.S.A. (1914.)
348. Whitaker, Mr F. Owen, 51, Grosvenor Avenue, Carshalton, Surrey. (1921.)
349. Whitehead, Mr T., D.Sc., A.R.C.S., University College of North Wales, Bangor. (1920.)
350. Wilkins, Mr W. H., M.A., Department of Botany, The University, Oxford. (1928.)
351. Williams, Mr P. H., 4, Belmont Villas, Windmill Lane, Cheshunt Herts. (1930.)

352. Williamson, Mrs H. S., B.Sc., 3, Verulam Buildings, Gray's Inn, London, W.C. 1. (1921.)
353. Wilson, Miss A. P., M.B.E., A.R.C.S., 116, Fellows Road, London, N.W. 3. (1929.)
354. Wilson, Mr Alastair R., B.Sc., North Clermiston House, Cramond Bridge, West Lothian, Scotland. (1933.)
355. Wilson, Mr Malcolm, D.Sc., A.R.C.S., F.L.S., Royal Botanic Garden, Edinburgh. (1921.)
356. Wiltshire, Mr S. P., M.A., Imperial Mycological Institute, Ferry Lane, Kew, Surrey. (1920.)
357. Wisconsin, The Library, University of, Madison, Wis., U.S.A. (1923.)
358. Wolf, Mr B. L., N.D.A., Cornwall Buildings, 45, Newhall Street, Birmingham. (1923.)
359. Woodcock, Mr A. J. A., M.Sc., F.E.S., Rhianva, 65, Rock Avenue, Gillingham, Kent. (1926.)
360. Woodward, Mr R. C., Ph.D., School of Rural Economy, Oxford. (1924.)
361. Woolhope, The Naturalists' Field Club, Hereford. (1896.)
362. Worcestershire Naturalists' Field Club, c/o Mr W. J. Else, Victoria Institute, Worcester. (1921.)
363. Wormald, Mr H., D.Sc., A.R.C.S., Research Station, East Malling, Kent. (1921.)
364. Wright, Mr E. Barton, M.Sc., Scottish Society for Research in Plant Breeding, Craig's House, Corstorphine, Midlothian. (1926.)
365. Yale University, Library, New Haven, Connecticut, U.S.A. (1930.)
366. Yeoman, Mr J. B., M.D., Norton, Wirral, Cheshire.
367. Young, Miss Elaine M., Ph.D., M.Sc., University of the Witwatersrand, Johannesburg, South Africa. (1927.)
368. Zundel, Dr G. L. I., Botany Building, Pennsylvania State College, State College, Pa., U.S.A. (1929.)
369. Zürich, Switzerland, Botanical Garden and Museum, c/o Dr A. U. Däniker. (1921.)

RULES

Society's Name and Objects

1. The Society shall be called "The British Mycological Society," and its object shall be the study of Mycology in all its branches.

Members of Society

2. The Society shall consist of Honorary Members, Foundation Members and Ordinary Members; the number of Honorary Members shall be limited to 20, and that of Foundation Members to 100, but the number of Ordinary Members shall be unlimited.

Honorary Members

3. Honorary Members shall be persons of pre-eminence in Mycology, or who have rendered special service to the Society.

Foundation Members

4. Foundation Members shall be those Members or Societies who joined the Society previous to the limit of 100 Members having been attained.*

Officers

5. The Officers of the Society shall consist of a President, one or more Vice-Presidents, Treasurer, Secretaries, and Editor or Editors. They shall be elected annually, at the Annual General Meeting of the Society.

Government of Society

6. The government of the Society shall be vested in a Council, which shall consist of the President and other Officers for the time being, together with two or more other Members who shall be elected annually at the General Meeting, and one-half of whom shall retire each year and not be eligible for immediate re-election. The Members to retire shall be those who have been longest in office, or in case of equality, shall be determined by ballot. Ex-Presidents are *ex-officio* Members of the Council.

Every Meeting of the Council shall be duly summoned by the Hon. Secretary by at least seven days' notice in writing to each Member of the Council.

Period of Office

7. The Officers and Council shall hold office as from the 1st of January following their election.

* The limit of 100 Foundation Members was reached 22nd October, 1903.

Plant Pathology Committee

8. The special interest of Plant Pathology shall be delegated to an executive committee, to be called the Plant Pathology Committee of the British Mycological Society. This Committee shall consist of the President and Secretaries *ex-officio* and twelve other members of the Society. The latter shall be elected annually at the Annual General Meeting of the Society, and one-quarter shall retire in rotation each year and shall not be eligible for immediate re-election. The members to retire shall be those who have been longest in office, or, in case of equality, shall be determined by ballot.

The Officers shall consist of a Chairman and a Secretary, to be elected by the Committee each year.

At least two meetings shall be held every year, six members to form a quorum.

The Committee shall have power to appoint for any special purpose a sub-committee consisting either wholly or partly of members of the Committee.

Election of Members

9. Honorary Members shall only be elected at a Meeting of the Society by a majority of the Members then present.

All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see Appendix) of recommendation, one at least of the proposers so certifying from personal knowledge. Every candidate for election shall sign an undertaking to abide by the Rules if elected (see Appendix). They shall be elected by a majority of the Members present at any meeting of the Society or by the President and Officers of the Society.

Subscription

10. All Ordinary Members and Societies shall pay an annual subscription of one pound, and Foundation Members five shillings, due on the 1st of January in each year. Honorary Members shall be exempt from any annual subscription.

Any Member wishing to retire from the Society shall give notice to the Hon. Secretary or Treasurer in writing before the 1st of December of the previous year.

Meetings

11. The Society shall hold one or more meetings annually, at a place and time determined by the Members at the preceding Annual General Meeting, or by the Council. The Annual General Meeting, for the election of officers and the transaction of other business, shall coincide with the Autumn Foray.

Accounts

12. At the Annual General Meeting of the Society in each year the Hon. Treasurer shall present duly audited accounts.

Alteration of Rules

13. The Rules shall not be altered except by a two-thirds majority of the Members present at an Annual General Meeting. A printed copy shall be sent to every Member of the Society on election, and in the event of alterations to all Members.

APPENDIX

Form of proposal for Ordinary Membership of the British Mycological Society

.....

of .....

.....

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society, and beg to recommend h for election.

Dated this day of 19

.....(From personal knowledge.)

Certificate to be signed by the Candidate

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

.....

INDEX

New names are indicated by an asterisk.

Abies pectinata, 274, 330
Abutilon Avicennae, 147
Acanthomyces Thaxt., 74
Acer, 302
  rubrum, 332
Achillea Ptarmica, 76
Agaricus campestris L., 188
  denticulatus Bolt. (Mycena pelianthina), 188
  dryophilus Bull., 253
  fascicularis Huds. (Hypholoma), 188
  floccosus Schaeff. (Pholiota squarrosa), 188
  glutinosus Schaeff. (Gomphidius), 188
  integer L. (Russula spp.), 188
  lignosus niger, 322
  plicatilis Sow. (Coprinus), 188
  stercorarius Bull. (Coprinus), 188
Agropyron occidentale, 263
Agrostis stolonifera, 31, 35, 37
Akanthomyces Lebert, 74, 75
  aculeata Lebert, 71, 72, 73, 74
Akrophyton tuberculatum Lebert, 74
Albizzia, 331
Alectoria jubata Ach., 109
  sarmentosa Ach., 107
Alnus viridis, 27
Alopecurus pratensis, 31, 32, 33, 35, 37
Alternaria and Macrosporium, the foundation species of, by S. P. Wiltshire, 135
Alternaria Nees, 44, 135, 136, 137, 138, 139, 140, 141, 147, 148, 150, 151, 152, 153, 154, 155, 156, 317, 318, 319
  Brassicae (Berk.) Sacc., 151
  Cheiranthi Bolle, 319
  Cheiranthi (Fr.), 318
  Cheiranthi (Fr.) Bolle, 148, 156, 158, 316, 317, 318, 319
  Cheiranthi (Fr.) Wiltshire, 319
  Citri Pierce, 150
  crassa (Sacc.) Rand, 150
  Dianthi Stev. & Hall, 137
  fasciculata (C. & Ell.) Jones & Grout, 150
  gossypina (Thüm.) Hopkins, 151
  longipes (Ell. & Everh.) Tisd. & Wadk., 150, 151
  macrospora Zimmerm., 150
  Panax Whetz., 151
  Solani (Ell. & Mart.) Jones & Grout, 150
  Sonchi Davis, 151
  tenuis auct., 150, 154, 157
  tenuis Nees, 135, 136, 137, 140, 150, 153, 155, 156, 157
Alternaria tenuis s. Bolle, 152
  tenuis s. Mason, 147
  *tenuissima (Fr.) Wiltshire nov. comb., 157
  Tomato (Cke.) Brinkm., 150
Alyssum argenteum, 76
Amaurochaete comata G. Lister & Brandza, 20
Amphisphaerella (Sacc.) W. Kirschst., 305, 306
  *amphisphaerioides (Sacc. & Speg.) W. Kirschst., nov. comb., 306
  *Arausiaca (H. Fabre) W. Kirschst., nov. comb., 306
  *canicollis (Karst.) W. Kirschst., nov. comb., 306
  *mycophila (Fr.) W. Kirschst., nov. comb., 306
  *prinicola (Berk. & Curt.) W. Kirschst., nov. comb., 306
  *protuberans (Karst.) W. Kirschst., nov. comb., 306
Amphisphaeria Ces. & de Not., 305
Anaptychia Koerb., 100
Ancylonycha Dejean, 58
"Animal Planta," 64
Annual General Meeting and thirty-sixth Autumn Foray, 7
Anthina cinnabarina B. & Br., 52
Anthomyia spreta Meig., 34
Antirrhinum, 76, 349
Antirrhinum majus, 199
Antiseptics, dilute, the stimulation of "sectoring" in mould colonies by, by L.D. Galloway, 161
Apion, 56
Apple scab, by R. W. Marsh, 176
Arcyria cinerea Pers., 28
Areca catechu, 334
Armillaria Fr., 337
Ascobolaceae, notes on the, by H. C. I. Gwynne-Vaughan and H. S. Williamson, 127
Ascobolus Pers., 131
  equinus (Mull.) Mass., 129
  furfuraceus Pers., 131, 132, 133
  Leveillei Boud., 128, 131, 132, 133
  viridulus Phill. & Plowr., 127, 128, 131, 132, 133
Ascochyta Lib., 276, 277, 278, 279
  pinodella Jones, 277, 279, 280, 281, 282, 283, 284, 285, 286, 288, 289, 290, 291, 292, 293, 294, 296, 297, 298, 299, 300
  pinodes Jones, 277, 298, 299, 300

Ascochyta Pisi Lib., 276, 277, 278, 279, 280, 282, 283, 284, 286, 289, 290, 291, 292, 293, 294, 296, 297, 298, 300
pisicola (Berk.) Sacc., 277
Rabiei (Pass.) Labrousse, 278, 299, 300
Viciae Lib., 277
vicicola Traill, 277
Ascodesmis van Tiegh., 105
Asparagus officinalis, 76, 350
Asparagus rust and antirrhinum rust in England, 1933, by G. H. Pethybridge, 349
Aspergillus Fr., 61, 89, 100
niger van Tiegh., 163
terreus Thom., 161, 162
Aspicilia esculenta Flag., 109
Aster (Michaelmas Daisy), 76, 77
Asterostroma laxum Bres., 7
Astrantia major, 76
Autumn Foray and Annual General Meeting, 7
Azotobacter Beij., 96, 102
*Azygozygum Chesters n.gen., 213
*Azygozygum chlamydosporum Chesters n.sp., 199, 213
Azygozygum chlamydosporum nov. gen. et sp., a Phycomycete associated with a diseased condition of *Antirrhinum majus*, by C. G. C. Chesters, 199

Bacidia flavovirescens Anzi, 5
Bacillus radicicola Beij., 96, 102
Bacterium tumefaciens Sm. & Towns., 338
Badhamia rubiginosa (Chev.) Rost., var. globosa Lister, 15
Barbeyella minutissima Meylan, 27
Barnes, B., "*Helotium ciliatosporum* Boudier," 76
"Laboratory devices," 171
Beaumont, A., "Potato blight," 174
Beauveria Vuill., 68
Belonioscypha Rehm, 84
ciliatospora Rehm, 84, 86
Berrya ammomilla, 332
Bescoby, H. B., "An attempt to measure the intensity of an attack of net blotch (*Helminthosporium teres* Sacc.) on barley," 180
Beta vulgaris, 147
Biatora Th. Fr., 106
granulosa Ew., 103
Blight diseases of certain cultivated leguminous plants, a comparative study of the fungi associated with, by A. Sattar, 276
Boletus bovinus Fr., 188
parasiticus (Bull.) Fr., 7
Bolinia Nits., 327
Bombyx (Orgyia) antiqua, 71
jacobea, 70
Botrytis Fr., 242, 244
antherarum Trifolii Schlecht, 244, 247
anthophila Bond, a systemic disease of red clover caused by, by R. A. Silow, 239
Botrytis anthophila Bond., 239, 240, 244, 245, 247
Trifolii Kingma, 244, 245, 246, 247
Bouteloua, 257, 259, 260, 261, 262
americana, 257, 260, 261
aristidoides, 258, 260, 261
breviseta, 261, 262
bromoides, 258, 260, 261
ciliata, 262
eriopoda, 257, 260, 261
heterostega, 257, 260, 261, 262
hirsuta, 260, 262
humilis, 261, 262
oligostachya, 259, 260, 261, 262
oligostachya var. major, 258, 260, 261
polystachya, 258, 260, 261
racemosa, 260
Brachypodium sylvaticum, 31
Brierley, W. B., "Discussion on the measurement of disease intensity," 182
British Uredinales, including one new to the British Isles, notes on, by W. B. Grove and C. G. C. Chesters, 265
Buddin, W., "Discussion on the measurement of disease intensity," 184
Buddleia variabilis, 77
Buellia disciformis Mudd., 110
praecavenda A. L. Sm., 16
Buller, A. H. R., "*Tilletia Tritici* and the discharge of its true basidiospores," 347
Buxus, 302, 303
Byssus nigra Fr., 106

Caeoma Kabatianum Bubák, 271
Calluna, 103
Calomastia, 305
Caloplaca Th. Fr., 100
marina Wedd., 108
Camarops Karst., 342
Canarium commune, 334
Carabus hortensis, 55
nemorensis, 55
Carduus palustris, 348
Carex, 148
arenaria, 269
Cassia, 331
nodosa, 332
Casuarina montana, 332
Celtis australis, 330
Centaurea dealbata, 76
macrocephala, 76, 77
nigra, 268, 269
Cerastis vaccinii, 72
Ceratostoma (Fr.) Sacc., 304, 307
*Masoni W. Kirschst., n.sp., 302, 303, 304, 306, 307
querceticolum (Crouan) Sacc., 307
rosellinioides Rehm, 307
Cetraria chlorophylla Wain., 5
islandica Ach., 101, 110
normoerica (Gunn.) Lynge, 312
tristis (Web.) Fr., 312

Chaetochloa geniculata, 262
imberbis, 262
Chaetomium Fr., 304
Cheiranthus Cheiri, 143, 147, 158
Cheiropodium flagellatum Syd., 150
Chesters, C. G. C., "*Azygozygum chlamydosporum* nov.gen. et sp., a Phycomycete associated with a diseased condition of *Antirrhinum majus*," 199
"Chicharra," 64
Chiodecton sanguineum Wain., 101
Chlorococcum infusionum, 95
Chlorocyphella Speg., 105
aeruginascens Keissl., 105
subtropica Speg., 105
Chrysanthemum indicum, 76
Chytridiaceous fungi, new, by F. K. Sparrow, Jr., 215
Ciboria ciliatospora Fuck., 84, 86
ciliatospora Fuck., var. minor Sacc. & Berl., 84
Cicada, 64
Cicer arietinum L., 276, 277, 278, 279, 285
Cienkowskia reticulata Rost., 20
Ciferri, R., "A few interesting North American smuts," 257
Cirsium eriophorum, 271
lanceolatum, 271, 273
Citharexylon cynocarpon, 325
Citrus, 321, 330, 331, 334, 337, 338
aurantium, 327
aurantium var. amara, 334
decumana, 332
Cladina Nyl., 100, 106
Cladonia Hill, 95, 97, 100, 102, 103, 106
caespiticia Floerke, 97
degenerans Spreng., 101
delicata Floercke, 97
glauca Floercke, 104
impexa Harm., 106
mitis Sandst., 101, 103, 106
nemoxyna Ach., 104
ochrochlora Floerke, 97, 98
polydactyla Floerke, 101
rangiferina Web., 101, 105
tenuis Harm., 101, 106
Cladophora, 106
Cladosporium Fr. & Lk., 33, 34
herbarum (Lk.) Fr., 143
Clapham, A. R., "Statistics," 180
Clasterisporium Schw., 148
caricinum Schw., 148
Clasterosporium Schw., 142, 149, 150, 153
caricinum Schw., 142, 149, 150
carpophilum (Lév.), 149
Hirudo Sacc., 150
hormiscioides Sacc., 150
maculatum Cke., 150
tenuissimum (Nees) Sacc., 142
vermiculatum Cke., 150
Clavaria (Vaill.) Fr., 302, 304
Botrytis (Pers.) Fr., 8
Fabae Sow., 170
Clavaria pistillaris (Linn.) Fr., 8
rugosa (Bull.) Fr., 170
setiformis Vahl., 55
Claviceps Tul., 49
balansioides Möller, 49
*flavella (B. & C.) Petch, nov.comb., 49, 63
Coccobotrys, 95
Coccomyxa, 95
Coenogonium nigrum A. Zahlbr., 106
Colloderma oculatum (Lippert) G. Lister, 14
Collybia butyracea (Bull.) Fr., 254
dryophila (Bull.) Fr., 253, 254, 255
Coniochaeta (Sacc.) P. Henn., 304, 305
Coniomela (Sacc.) W. Kirschst., 305, 306
*Millegrana (Schw.) W. Kirschst., nov. comb., 306
*pulverulacea (Ehrh.) W. Kirschst., nov. comb., 306
*rimincola (Rehm) W. Kirschst., nov. comb., 306
*Rosarum (Niessl.) W. Kirschst., nov. comb., 306
Coniophora cerebella Pers., 92
Coprinus (Pers.) Fr., 188
Cordyceps Fr., 48, 51, 52, 55, 59, 62
acicularis Rav., 51, 58, 59, 60, 61
ainictos Möller, 60, 61
armeniaca B. & C., 63
australis Speg., 57
Barnesii Thwaites, 60
bicephala Peck, 62, 66, 67
brasiliensis P. Henn., 61, 62
caespitosa (Tul.) Sacc., 65
caespitoso-filiformis P. Henn., 52
caloceroides B. & C., 63
capitata (Holmsk.) Lk., 7
Carabi Quél., 54
Carolinensis Rav., 60
cinerea (Tul.) Sacc., 54
clavulata (Schw.) Ell. & Everh., 53, 54
coccinea Penz. & Sacc., 50
coccinea Penz. & Sacc. var. subochracea Penz. & Sacc., 50
concurrens Lloyd, 52
deflectens Penz. & Sacc., 49
dipterigena B. & Br., 48, 51, 63, 65
Ditmari Quél., 55, 62, 63
Doassansii Pat., 53, 54
entomorrhiza (Dicks.) Lk., 54, 55, 56, 57, 62
falcata Berk., 51, 59
fasciculata Pat., 52
flavella B. & C., 48, 49
flavobrunnescens P. Henn., 49
fuliginosa Ces., 71
gentilis (Ces.) Sacc., 62, 65
Glaziovii P. Henn., 56, 57
gracilis Mont. & Dur., 54, 55, 56, 57, 67
Huberiana P. Henn., 66
Humberti Robin, 62
incarnata Möll., 49

Cordyceps interrupta v. Höhn., 65
lachnopoda Penz. & Sacc., 62
Langloisii Ell. & Everh., 63
Lloydii Fawcett, 67
martialis Speg., 57, 58
menesteridis Muell. & Berk., 57
militaris (L.) Lk., 50, 51, 52
Miquelii (Tul.) Sacc., 65
miryensis P. Henn., 51
mitrata Pat., 50
Montagnei Berk., 64
myrmecophila Ces., 48, 66
nutans Pat., 62, 66
Odyneri Quél., 63
olivacea Rick, 61
olivaceo-virescens P. Henn., 61
ophioglossoides (Ehrenb.) Lk., 57
oxycephala Penz. & Sacc., 62
palustris B. & Br., 58
pistillariaeformis B. & Br., 53
polyarthra Möll., 52, 53
proliferans P. Henn., 66
pruinosa Petch, 51, 52
Puiggarii Speg., 62
Ravenelii B. & C., 58, 59, 60
rhizomorpha Möll., 66
Rickii Lloyd, 58
Robertsii Berk., 51
Schlechteri P. Henn., 65
Scottiana Oliff, 57
Shiraiana P. Henn., 65
Sinclairii Berk., 64, 65
sobolifera (Hill) Sacc., 64, 65
sphecocephala (Klotz.) Cke., 51, 55, 61, 62
sphingium (Tul.) B. & C., 74, 75
stylophora Berk. & Br., 60
submilitaris P. Henn., 57, 58
subochracea Penz. & Sacc., 50
subpolyarthra P. Henn., 52
subunilateralis P. Henn., 66
superficialis (Peck) Sacc., 60
surinamensis P. Henn., 65
thyrsoides Möll., 62
tuberculatum (Lebert) Maire, 74
typhulaeformis B. & Cke., 49, 50, 51
unilateralis (Tul.) Sacc., 51, 66
Voeltzkowii P. Henn., 64
Wittii P. Henn., 63
Coreopsis grandiflora, 76
Cornicularia aculeata Ach., 103
fucina (Gmel.) Ach., 312
normoerica DR., f. fucoides A. Zahlbr., 312
normoerica (Gunn.) DR., 312, 313
normoerica (Gunn.) DR., f. fucoides (Wulf.) A. Zahlbr., 313
tristis (Web.) Ach., 312
Cortinarius collinitus (Sow.) Fr., 8
myritillinus Fr., 8
spilomeus Fr., 8
uliginosus Berk., 8
Corylus, 302
Craterium Trent., 20
Cribraria microcarpa (Schrad.) Pers., 15
purpurea Schrad., 23
Crocynia Miss., 101
lanuginosa Hue., 101
Crutchlow, H., "Notes on forms of *Synchytrium* from North Wales," 348
Cucurbita lagenaria, 147
Cucurbitariella Petr., 305, 306
Cucurbitula Fuck., 305, 306
conglobata (Fr.) Fuck., 306
*moravica (Petr.) W. Kirschst., nov. comb., 306
Myricariae Fuck., 306
Syringae (Kickx) Lamb., 306
Cyphella Fr., 315
Cystococcus, 96, 105

Dactylis glomerata, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 45
Dactylococcus, 99
Daldinia Ces. & de Not., 323, 324, 342
concentrica (Bolt.) Ces. & de Not., 322
Darbishire, O. V., "The *Lichen fucoides* of various authors and its fate," 308
Dasyobolus Sacc., 131
immersus (Pers.) Sacc., 131, 132, 133
Dates of Publication of Sowerby's *English Fungi*, by J. Ramsbottom, 167
Daucus Carota, 268
Delphinium elatum, 76
Dennis, R. W. G., "Studies in the morphology and biology of *Helminthosporium Avenae*," 223
Depazea pisicola Berk., 277
Dermatocarpon Eschw., 95, 99
miniatum Th. Fr., 108
Derris robusta, 332
Diachea leucopoda Rost., 28
Dianthus, 140, 157
Dichrostachys nutans, 340
Diderma Pers., 25
floriforme Pers., 15
niveum Macbr., 25
ochraceum G. F. Hoffmann, 23
rugosum Lister, 20
Didymium difforme Duby, 28
ochroideum G. Lister, 28
squamulosum Fr., 22
Diponera grandis, 66
Disease intensity, symposium and discussion on the measurement of, 21st January, 1933, 174
Ditiola Fr., 315
Doronicum plantagineum, 76
Drummond, R., "Notes on the blackening of apples caused by *Sclerotina fructigena* and on the wither-tip disease of plums caused by *Sclerotinia cinerea*," 348
Dry Rot in Wood, 2nd ed. Bull. No. 1, Forest Products Research Laboratory. Review by J. Ramsbottom, 92

Eccilia griseorubella (Lasch) Fr., 8
rhodocyclix (Lasch) Fr., 7
English index to Persoon's *Synopsis*, by J. Ramsbottom, 187
Entoloma excentricum Bres., 8
griseocyaneum Fr., 7
Entomogenous fungi, notes on, by T. Petch, 48
Epichloe typhina, the systemic infection of grasses by, by K. Sampson, 30
Epichloe typhina (Pers.) Tul., 30, 31, 32, 33, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46
Erigeron multiradiatus, 76
Ervum lens, 276, 279
Eucalyptus, 334
Eugenia, 333
Euglena, 217
Euphorbia, 274
dulcis, 273, 274
Lathyris, 274
pilosa, 274
platyphyllos, 274
stricta, 274
Eurosellinia Sacc., 305
Evernia divaricata Ach., 107
prunastri Ach., 98, 109
Exobasidium mycetophilum (Peck) Burt, 253, 254

Fagus, 302, 328, 329
Ferula, 268
Festuca duriuscula, 44
elatior, 39
ovina, 31, 34, 35, 36, 37
rubra, 31, 32, 33, 34, 35, 36, 37, 38, 39, 42, 43, 44, 45, 46
spadicea, 44
Ficus, 147, 337
obtusa, 336
Flammula limulata Fr., 8
Fomes cryptarum Fr., 92
lignosus Kl., 334
Forays:
Haslemere, 7
Ludlow, 1
Fraxinus, 302
Fuligo Haller, 22, 28
septica Gmel., 21, 22
Fungi associated with blight diseases of certain cultivated leguminous plants, a comparative study of, by A. Sattar, 276
Fungus quercinus niger Ray, 322
Fusarium Lk., 44, 185, 224, 249
bulbigenum Cke. & Mass., 250, 251
culmorum (W. G. Sm.) Sacc., 224, 249, 250, 251
culmorum (W. G. Sm.) Sacc., Rotting of *Galtonia* bulbs caused by, by A. K. Ghamrawy, 249
nivale (Fr.) Sor., 224

Galium saxatile, 348
Galloway, L. D., "Note on an unusual mould fungus," 163
Galloway, L. D., "The stimulation by dilute antiseptics of 'sectoring' in mould colonies," 161
Galtonia, bulb rot of, 249
Geoglossum Pers., 315
Ghamrawy, A. K., "Rotting of *Galtonia* bulbs caused by *Fusarium culmorum* (W. G. Sm.) Sacc., and *Penicillium corymbiferum* Westling," 249
Gibellula Cav., 52, 53
aranearum (Schw.) Syd., 71, 72
eximia v. Höhn., 53
Glaux maritima, 267, 268
Gnomonia Gei Pat. & Doass., 54
Gomphidius Fr., 188
gracilis Berk. & Br., 7, 8
Grevillea, 331, 333, 341
robusta, 337
Grimmia incurva, 5
Grove, W. B. and Chesters, C. G. C., "Notes on British Uredinales, including one new to the British Isles," 265
Gwynne-Vaughan, H. C. I. and Williamson, H. S., "Notes on the Ascobolaceae," 127
Gymnoconia Cirsii-lanceolati Bubák, 271
Gyrophora Ach., 99
cylindrica (L.) Ach., 311, 313
Muhlenbergii Ach., 109

Halmilla, 333
Halophila prasinana, 71
Haplographium Berk. & Br., 164
delicatum Berk. & Br., 165
echinatum (Riv.) Sacc., 164
Hedera, 302, 303
Helminthosphaeria Fuck., 304, 305
Clavariae (Tul.) Fuck., 305
*ligniaria (Grev.) W. Kirschst., nov. comb., 305
*malacotricha (Niessl.) W. Kirschst., nov.comb., 305
*palustris (Schroet.) W. Kirschst., nov. comb., 305
*sanguinolenta (Wallr.) W. Kirschst., nov.comb., 305
*tunicata (W. Kirschst.) W. Kirschst., nov.comb., 305
*velutina (Fuck.) W. Kirschst., nov. comb., 305
Helminthosporium Lk., 150, 185, 223, 224, 225, 226, 236
Avenae, studies in the morphology and biology of, by R. W. G. Dennis, 223
Avenae Eidam, 223, 224, 225, 226, 227, 228, 229, 230, 231, 233, 234, 235, 236
carpophilum Lév., 150
Cheiranthi Libert, 142, 143, 147, 319
Clavariae Desm., 304

Helminthosporium gramineum Rabenh., 184, 223, 228, 230, 234
sativum Pamm., King & Bakke, 224, 226, 227
tenuissimum Nees, 141
teres Sacc., 180, 185, 223, 229
teres Sacc., f. Avenae sativae Br. & Cav., 223
Helmisporium tenerum Kunze, 139, 140
tenuissimum Kunze, 138
Helotium Fr., 76
Helotium ciliatosporum Boudier, by B. Barnes, 76
ciliatosporum Boud., 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86
scutula Karst., 76, 78, 80, 84, 86
Verbenae Cav., 84
Hemitrichia Serpula Rost., 28
vesparium (Batsch) Macbr., 15
Hendersonula (*H. toruloidea*), a new species of, on deciduous trees in Egypt, by R. M. Nattrass, 189
*Hendersonula toruloidea Nattrass, n.sp., 189, 197
Hepialus, 67
humuli, 74
Heterochaetella crystallina Bourd., 1
Heterosporium Klotz., 140, 148
Hevea, 332, 333, 334, 340, 341, 342, 343
brasiliensis, 331, 332, 333, 334, 337, 341
Hibiscus, 334, 337
Hippuris vulgaris, 268
Hirsutella Pat., 55, 71
Eleutheratorum (Nees) Petch, 55
*lecaniicola (Jaap) Petch, nov.comb., 53
subulata Petch, 71
Holcus lanatus, 31, 34, 35, 36, 37
mollis, 31, 32, 37
Humaria granulata (Bull.) Quél., 133
Humicola Traaen, 212
Hygrophorus chrysodon Fr., 8
Hymenopodium Corda, 150
Hymenostilbe Petch, 67, 75
formicarum Petch, 67
melanopoda (Speg.) Petch, 66, 67
Hypholoma Fr., 188
Hypogymnia (Nyl.) Wats., 106
Hypoxylon Bull. 305, 326, 327, 340, 342
deustum (Hoffm.) Grev., 324
gigaspermum P. Henn., 330, 331
macrospermum Mont., 325
pauperatum Karst., 305
pavimentosum Ces., 327, 329
tessulatum Berk., 327
tuberiforme Wallr., 325, 329
tubulina A. & S., 325
tubulina Fr., 330
ustulatum Bull., 321, 323, 324, 325, 326, 327, 342

Icmadophila ericetorum, 95
Inocybe corydalina Quél., 8
descissa Fr., 8
Ionaspis, 94, 106
Isaria Pers., 48, 52, 67, 71
Abutii Lloyd, 72
amoene-rosea P. Henn., 52
amorpha v. Höhn., 65
arbuscula Hariot, 65
Cicadae Miquel, 65
cinnabarina Preuss, 68, 69
corallina Fr., 68, 69
Cosmopsaltriae Yasuda, 65
curvispora Pat., 52
dubia Delacr., 67
Dussii Pat., 52, 53
Eleutheratorum Nees, 55, 56
exoleta Fr., 70, 71
farinosa (Dicks.) Fr., 67, 69
floccosa Fr., 70, 71, 72
gigantea Mass., 64
Harioti Arnaud, 65
japonica Yasuda, 53
lecaniicola Jaap, 53
leprosa Fr., 67, 68, 69
Mokanshawii N. Gist Gee, 65
myrmicidae Lloyd, 66
nigra Yakush. & Kumaz., 56
ochracea Boud., 71
*Orthopterorum Petch n.sp., 70
palmatifida P. Henn., 52, 53
pistillariaeformis Pat., 74
Sinclairii (Berk.) Petch, 64, 65
sphingum Schw., 72, 74, 75
strigosa Fr., 70, 71, 74

Jackya Cirsii-lanceolati Bubák, 271

Kirschstein, W., "Remarks on a collection of British species of *Rosellinia* and a redistribution of the species of that genus," 302
Kleistobolus pusillus Lippert, 27
Knight, H. H., "Lichens of the Haslemere foray," 16
Knight, H. H., "Lichens of the Ludlow district," 5
Koeleria cristata, 31, 34, 35, 36, 37
Kretschmaria Fr., 337
micropus Berk., 335, 336, 342

Laboratory devices, by B. Barnes, 171
Laccaria laccata (Scop.) Berk. & Br., 254
tortilis (Bolt.) Boud., 8
Lachnea cretea Cke., 128, 133
Lactarius controversus (Pers.) Fr., 7
flavidus Boud., 8
spinulosus Quél., 7
Lafoensis, 331
vandelliana, 332
Lamproderma Rost., 25, 26, 28
atrosporum Meylan, 25
echinulatum Rost., 25
splendens Meylan, 25
violaceum Rost., 25, 26
violaceum Rost., var. Carestiae Lister, 26

Lamproderma violaceum Rost., var. Sauteri Lister, 26
Lavandula officinalis, 76
Lecanactis abietina Koerb., 5
Lecanora Ach., 5, 99
actophila Wedd., 108
esculenta Eversm., 109
Hageni Ach., 109
leprosa Fée, 110
muralis Schaer., 5
subfusca Ach., 94, 105
subfuscata Magn., 105
Lecidea Ach., 5, 106
lucida Ach., 5
uliginosa Ach., 97
Lentinus lepideus Fr., 92
Lepidoderma de By., 23
tigrinum Rost., 23
Lepra Hall., 97, 110
Lepraria Ach., 97
Leptosphaeria Avenae Auersw., 223
silenes-acaulis de Not., 54
Leucaena glauca, 342
Lichen-agaricus Mich., 322, 330
Lichen-agaricus crustaceus Mich., 322
Lichen corniculatus Lightft., 312
Lichen fucinus Gmelin, 312
Lichen fucoides, the, of various authors, and its fate, by O. V. Darbishire, 308
Lichen fucoides de Neck., 311, 313
Lichen fucoides Dicks., 308, 309, 310, 311, 313
Lichen fucoides Latourrette, 312, 313
Lichen fucoides Wulfen, 312, 313
Lichen normoericus Gunn., 312
Lichen tristis Web., 312
Lichens of the Haslemere foray, by H. H. Knight, 16
Lichens of the Ludlow district, by H. H. Knight, 5
Lichina pygmaea Ag., 102
Lister, G., "Mycetozoa found during the Haslemere foray," 14
Lister, G., Presidential Address, "Field notes on Mycetozoa," 18
Lobaria Schreb., 98, 99
laciniata Wain., 98
Lolium, 32, 44, 45
perenne, 44
temulentum, 44
Lunumidella, 333
Luzula campestris, 271
maxima, 271
Lychnis coronaria, 77
Lycoperdon fraxineum Huds., 322, 323, 324
recolligens Sow., 169
stellatum Rehl., 169

McDonald, J., "Two new records of physiologic forms of wheat-stem rust in Kenya Colony," 218
Macrosporium and *Alternaria*, the foundation species of, by S. P. Wiltshire, 135
Macrosporium Fr., 135, 137, 142, 150, 151, 152, 153, 154, 155, 156
Alliorum Cke., 151
Camelliae Cke. & Mass., 151
caricinum Fr., 137, 148, 149, 153
Cheiranthi (Libert) Fr., 137, 138, 142, 143, 144, 146, 147, 148, 153, 154, 158, 316, 317, 318, 319
commune Rabenh., 147, 154, 155
Convallariae (Schum.) Fr., 137, 138, 153
Eriobotryae Cristof., 151
nigricantium Atkins., 151, 152
obtusum Berk., 147
parasiticum Thüm., 151
Porri Ell., 150
Ricini (Cke.) Berl. & Vogl., 150
rosarium Penzig, 155
sarcinaeformae Cav., 151
sarcinula Berk., 148, 151, 154, 155
Sesami Kawam., 150
Sophorae Turc. & Maff., 151
Symplocarpi Syd., 151
tenuissimum (Nees) Fr., 137, 138, 139, 140, 141, 142, 153, 154, 156, 157
Tomato Cke., 150
verruculosum Bubák, 151
Mahonia aquifolium, 1
Marasmius alliaceus (Jacq.) Fr., 8
dryophila (Bull.) Karst., 253
globularis Fr., 8
Marsh, R. W., "Apple scab," 176
Medicago, 270
hispida, 270
maculata, 270
Melampsora Cast., 274
Euphorbiae-dulcis Otth., 273
Symphyti (DC) Bubák, 1, 265, 272, 274, 275
Melia ducia, 332
Meliola Fr., 150
Melissa officinalis, 76, 77
Melosira varians, 216
Memnoniella aterrima v. Höhn., 164
*echinata (Riv.) Galloway, nov. comb., 165
Mentha, 76, 77, 86
Merulius lacrymans (Wulf.) Fr., 92
Monarda didyma, 76
Moore, M. H., "Discussion on the measurement of disease intensity," 186
Mortierella Coem., 212
polycephala Coem., 212
stylospora Dixon-Stewart, 212
Morus alba, 334
Mycena pelianthina Fr., 188
Mycetozoa, 14, 18
Mycetozoa, field notes on, Presidential Address by G. Lister, 18
Mycetozoa found during the Haslemere Foray, by G. Lister, 14
Mycological nomenclature, notes on, by J. Ramsbottom, 314

Mycosphaerella pinodes (Berk. & Blox.) Stone, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 288, 289, 290, 291, 292, 293, 294, 296, 297, 299, 300
Mygale, 63, 64
Myrica cerifera, 27

Nattrass, R. M., "A new species of *Hendersonula* (*H. toruloidea*) on deciduous trees in Egypt," 189
Neatby, K. W., "Recent advances in plant breeding for disease resistance, with special reference to the rust problem," 347
Nepenthes, 66
Nephroma parile Gyeln., 108
Net blotch (*Helminthosporium teres* Sacc.) on barley, an attempt to measure the intensity of an attack of, by H. B. Bescoby, 180
Nitzschia Otth., 216
Noctua exoleta, 71
  Ypsilon, 70
North American smuts, a few interesting, by R. Ciferri, 257
Nostoc, 95, 98, 99
Note on an unusual mould fungus, by L. D. Galloway, 163
Notes on British Uredinales, including one new to the British Isles, by W. B. Grove and C. G. C. Chesters, 265
Notes on entomogenous fungi, by T. Petch, 48
Notes on forms of *Synchytrium* from North Wales, by H. Crutchlow, 348
Notes on mycological nomenclature, by J. Ramsbottom, 314
Notes on the Ascobolaceae, by H. C. I. Gwynne-Vaughan and H. S. Williamson, 127
Notes on the blackening of apples caused by *Sclerotinia fructigena* and on the wither-tip disease of plums caused by *Sclerotinia cinerea*, by R. Drummond, 348
Nummularia Jul., 327
  macrosperma Pat., 331
  tubulina (A. & S.) Mill., 327

Oedocephalum antophilum Jaczewski, 244
Oenanthe aquatica, 268
  crocata, 268, 275
Ophiobolus graminis Sacc., 185
Ophiocordyceps Petch, 53, 61, 63
  *acicularis (Rav.) Petch, nov. comb., 60
  *caloceroides (B. & C.) Petch, nov. comb., 64
  *clavulata (Schw.) Petch, nov. comb., 53
Orthosia incerta, 68

Paeonia officinalis, 76
Panicum geniculatum, 262
Panicum imberbe, 262
Parmelia Ach., 106
  ambigua Ach., 5
  conspersa Ach., 106
  corniculata A. L. Sm., 312
  encausta Ach., 110
  fuciformis Ach., 309
  perforata S. F. Gray, 110
  phycopsis Ach., 308, 309
  physodes Ach., 103, 104, 109
  saxatilis Ach., 108
  scopulorum Ach., 309
  stygia Ach., 110
  vagans Nyl., 109
Pastinaca, 268
Paxillus panuoides Fr., 92
Peltigera Willd., 98, 104
  aphthosa Willd., 95, 99, 108
  venosa Hoffm., 95
Penicillium, some new species of, by G. Smith, 88
Penicillium, 61, 88, 100, 163, 164, 249, 250, 251
  brevi-compactum Dierckx, 88
  *Charlesii G. Smith, n.sp., 88, 90
  corymbiferum Westling, rotting of *Galtonia* bulbs caused by, by A. K. Ghamrawy, 249
  corymbiferum Westling, 249, 250
  echinatum Dale, 164
  echinatum Riv., 163
  nigricans Bain., 164
  *pallidum G. Smith, n.sp., 88, 89
  Putterillii Thom, 89
  *Raistrickii G. Smith, n.sp., 88, 90
  spiculisporum Lehm., 100
  stoloniferum Thom, 88
  *varians G. Smith, n.sp., 88, 89, 90
Peniophora Cke., 1
  sublaevis (Bres.) v. Höhn. & Litsch., 2
Perichaena Fr., 28
Persoon's *Synopsis*, English Index to, by J. Ramsbottom, 187
Pertusaria DC., 94
  communis DC., 96
  pertusa Dal. Tor. & Sarnth., 96
Petch, T., "Notes on entomogenous fungi," 48
Pethybridge, G. H., "Asparagus rust and antirrhinum rust in England, 1933," 349
Peucedanum sativum, 268
Peziza Dill., 188
Phaseolus, 277
Phialea appendiculata Oudem., 84
Phleum pratense, 30, 31, 33, 35
Phlox paniculata, 76
Phoenix reclinata, 332
Pholiota squarrosa (Müll.) Fr., 188
Phoma Fr., 193, 228, 277, 298
Phyllocarbon Yasudai, 335
Phyllosticta Pers., 278
  Antirrhini Syd., 199, 213

Phyllosticta cicerina Prill. & Delacr., 278
Rabiei (Pass.) Trotter, 278, 279, 280, 282, 283, 284, 285, 286, 288, 289, 290, 291, 292, 293, 294, 296, 298, 299, 300
solitaria Ell. & Everh., 228
Viciae Cke., 277
Physarum Pers., 20
alpinum G. Lister, 25
bogorcense Racib., 20
conglomeratum Rost., 14
globuliferum Pers., 21
Maydis Torrend, 28
murinum Lister, 21
nutans Pers., 20, 21
Serpula Morgan, 20
tenerum Rex, 20
virescens Ditm., 14
viride Pers., 20, 21
viride var. aurantium Lister, 21
viride var. incanum Lister, 21
Physcia ocellata, 98
Phytophthora de By., 337
Picea alba, 330
canadensis, 110
Pinus Mughus, 27
sylvestris, 109
Pisum sativum, 276, 277, 279
Placodium DC. emend. Hepp., 99, 100
Plantago lanceolata, 348
Plant breeding for disease resistance, recent advances in, with special reference to the rust problem, by K. W. Neatby, 347
Plasmopara viticola (Berk. & Curt.) Berl. & de Toni, 9
Platysma Nyl., 106
*Pleolpidium Polyphagi Sparrow, n.sp., 215
Pleospora Avenae Rathschl., 224, 229
herbarum (Pers.) Rabenh., 151, 154
Pleurococcus Chodati, 95
monas, 95
Naegelii, 95
Pleurotus atrocaeruleus Fr., 8
Poa bulbosa, 31, 32, 37
pratensis, 37
trivialis, 31
*Podochytrium lanceolatum Sparrow n.sp., 216
Polymeria Ach., 309
Polyphagus Euglenae, 215
Populus (poplar), 77
Poria vaporaria (Pers.) Fr., 92
Porina Ach., 98
Potato blight, by A. Beaumont, 174
Potentilla Fragariastrum, 348
Presidential Address, by G. Lister, "Field Notes on Mycetozoa," 18
Proceedings, 347
Protoderma Rost., 217
Psalliota Fr., 347
Pseudophacidium Karst., 96
Psora decipiens Hook., 109
Puccinia Acetosae Körn., 269
Antirrhini Diet. & Holw., 349
arenariicola Plowr., 268
Asparagi DC., 350
Cirsii-lanceolati Schröt., 271, 272
Convallariae Lagerh., 137
glumarum (Schm.) Erikss. & Henn., 270
graminis-tritici Erikss. & Henn., 218, 347
Luzulae-maximae Diet., 270
mirabilissima Peck, 1
oblongata Wint., 271
Schoeleriana Plowr. & Magn., 268, 269
Trailii Plowr., 269, 275
Pyronema Carus, 105

Quercus, 302, 304, 342
virens, 328

Racodium rupestre Pers., 106
Radulum quercinum Fr., 1
Ramalina siliquosa (Huds.) A. L. Sm., 309
Ramsbottom, J., "Fungi as scavengers," 8
"Dates of publication of Sowerby's *English Fungi*," 167
"English index to Persoon's *Synopsis*," 187
"Notes on mycological nomenclature," 314
Review: *Dry Rot in Wood*. 2nd ed. Bull. No. 1, Forest Products Research Laboratory, 92
"*Tremella mycetophila* Peck," 253
Ranunculus, 157
asiaticus, 140
Recent lichen literature, by A. Lorrain Smith, 93
Rhachomyces Thaxt., 74
Rhizidiocystis Ananasi Sideris, 210
*Rhizidiopsis Sparrow, n.gen., 216
*emmanuelensis Sparrow, n.sp., 216
Rhizocarpon (Ramond) DC., 106
Rhizoctonia DC., 321, 337, 339, 340, 341, 342
bataticola (Taub.) Butler, 339, 340, 341
Solani Kühn, 199, 213
Rhizotrogus, 58
Rhytisma Fr., 315
Roccella DC., 106, 311
Arnoldi Wain., 308, 309, 313
Boergensenii Wain., 311
Dillenii Bory, 312, 313
fastigiata Bory, 312
fuciformis (L.) DC., 309, 310, 311, 313
fucoides (Dicks.) Wain., 309, 310, 311
fucoides Wain., 309, 311
phycopsis Ach., 308, 309, 310, 311, 313
tinctoria DC., 308, 309, 310, 312, 313
Rosellinia, remarks on a collection of British species of, and a redistribution of the species of that genus, by W. Kirschstein, 302

Rosellinia de Not., 302, 303, 304, 305, 306, 333
aquila (Fr.) de Not., 302, 303, 305, 306
araneosa (Pers.) Sacc., 306
Buxi H. Fabre, 302, 303, 306
callosa Wint., 306
Clavariae (Tul.) Wint., 302, 304
fusispora W. Kirschst., 306
ligniaria (Grev.) Nits., 302, 303, 304
mammiformis (Pers.) int., 302, 303, 305, 306
pulveracea (Ehrenb.) Fuck., 304
thelena (Fr.) Rabenh., 302, 303, 306
velutina Fuck., 302, 304
Rumex Acetosa, 269, 275
Acetosella, 269
Russula Fr., 188
luteotacta Rea, 8
pseudointegra Arn. & Goris, 8

Saccobolus Boud., 131
depauperatus (B. & Br.) Phill., 130, 133
Sampson, K., "The systemic infection of grasses by *Epichloe typhina* (Pers.) Tul.," 30
Sattar, A., "A comparative study of the fungi associated with blight diseases of certain cultivated leguminous plants," 276
Saxifraga oppositifolia, 348
*Scherffelia Sparrow n.gen., 216
*parasitans Sparrow n.sp., 216
Scirpus, 268
fluviatilis, 267
maritimus, 267, 268
Scleroderma Pers., 7
Sclerotinia cinerea Schröt., 348
fructigena Schröt., 348
Sclerotium Tode, 48
Scolopia, 335
Scytonema, 95, 98
"Sectoring" in mould colonies, the stimulation by dilute antiseptics of, by L. D. Galloway, 161
Senecio Jacobaea, 269
Sepedonium Lk., 162
*Septolpidium Sparrow, n.gen., 215
lineare Sparrow, n.sp., 215
Sequoia sempervirens, 92
Setaria, 263
geniculata, 262, 263
glauca, 263
gracilis, 263
imberbis, 262, 263
Silow, R. A., "A systemic disease of red clover caused by *Botrytis anthophila* Bond.," 239
Sium, 268
erectum, 268
Smith, A. Lorrain, "Recent lichen literature," 93
Smith, G., "Some new species of Penicillium," 88
Smuts, North American, a few interesting, by R. Ciferri, 257
Solenia Hoffm., 315
Solidago serotina, 76
Solorina Ach., 95
spongiosa Carroll, 95
Sordaria Ces. & de Not., 304
Sowerby's *English Fungi*, dates of publication of, by J. Ramsbottom, 167
Sparrow, F. K., Jr., "New Chytridiaceous fungi," 215
Spergularia, 265
marginata, 265
marina, 265, 266, 267, 275
media Presl., 267
salina Presl., 267
*Sphacelotheca Magnusiana (Fisch. de Waldh.) Cif., nov. comb., 262, 263
pamparum Clint., 262, 263
Sphaeria Hall, 54, 327
Basili Taylor, 65
capitata Rav., 57
concentrica Bolt., 324
deusta Hoff., 321, 323, 324, 325, 326, 335
deusta Hoff. a. sessilis A. & S., 323
deusta Hoff. b. platyceps A. & S., 323
entomorrhiza Dickson, 57, 169
fraxinea Hall, 323, 324
lycoperdoides Weig., 322
lycoperdoides Weig. a. fragilis Latour., 322
lycoperdoides Weig. b. confluens Latour., 322
lycoperdoides Weig. c. nigra Latour., 322
lycoperdoides Weig. d. maxima Latour., 322
maxima Hall, 321, 322, 323, 324, 325
maxima convexa nigerrima Hall, 322
ophioglossoides Rav., 57
platyceps Pers., 323
querceticola Crouan, 307
Sinclairii Berk., 64
sobolifera Hill, 64
teres Schw., 327
tubaeformis Tode, 325
tubulina A. & S., 323, 327
typhina Pers., 30
versipellis Tode, 323
zonata Lév., 321, 325
Sphaerostilbe repens Berk. & Br., 343
Sphinx ligustri, 68
pinastri, 75
Sporodesmium Lk., 142, 149
closterisporium Corda, 149
*Sporophlyctidium Sparrow, n.gen., 217
*africanum Sparrow, n.sp., 217
Sporotrichum Lk., 69
Isariae Petch, 69
Spring Foray 1932, 1
Squamaria DC., 99
Stachybotrys Corda, 163, 166
Statistics, by A. R. Clapham, 180

Staurothele catalepta (Ach.) Zsch. var. fluviatilis Erichs., 109
Stemphylium Wallr., 148
botryosum s. Oudemans, 152
Solani Web., 151
Stenocybe byssacea Nyl., 5
Stereocaulon Schreb., 5, 95, 97, 98, 99
coralloides Fr., 99
Stereum frustulosum (Pers.) Fr., 92
Stilbella Lind., 55, 56
*setiformis (Vahl) Petch, nov. comb., 55, 56
Stilbum Tode, 53, 303
formicarum Cke. & Mass., 66
Ustulinae Pat., 330, 342
Stromatinia baccarum (Schröt.) Boud., 1, 2
Stromatosphaeria deusta Grev., 324
Symphytum asperrimum, 274
officinale, 274, 275
peregrinum, 1, 274
Symposium and discussion on the measurement of disease intensity, 21st January, 1933, 174
Synchytrium de By. & Wor., 348
aureum Schröt., 348
aureum Schröt. var. Galii Rytz, 348
Potentillae (Schröt.) Lagerh., 348
Taraxaci de By. & Wor., 348
Synchytrium, Notes on forms of, from North Wales, by H. Crutchlow, 348
Synedra, 215

Tassiella Sacc., 305
Taxus, 342
Teloschistes brevior Hillm. var. halophila Oxn., 109, 111
Tephrosia candida, 333
Thamnolia vermicularis (Sw.) Schaer., 106
Theissenia Maubl., 331
pyrenocrata (Theiss.) Maubl., 331
Thelephora spiculosa (Fr.) Burt., 8
Thelidium sparsulum A. L. Sm., 16
Thelotrema lepadinum Ach., 5
Thrombium (Wallr.) Mass., 16
Thuja plicata, 92
Thymus Serpyllum, 348
Thyrospora Tehon & Daniels, 155, 156
sarcinaeforme (Cav.) Tehon & Daniels, 155
Tilletia Tull., 262, 263
Earlei Griff., 263
Magnusiana Fisch. de Waldh., 262
Tritici (Bjerk.) Wint., 347
Tritici and the discharge of its true basidiospores, by A. H. R. Buller, 347
Tolyposporium pamparum Cif., 263
pampeanum Speg., 263
Torrubia caespitosa Tul., 65
cinerea Tul., 54
Eleutheratorum (Nees) Schröt., 55
Miquelii Tul., 65
superficialis Peck, 60
Torula Pers., 136, 190, 191, 192, 193, 194, 195, 196
alternata Fr., 135, 156
Trebouxia, 95
Tremella mycetophila Peck, by J. Ramsbottom, 253
Tremella mycetophila Peck, 253, 254, 255
tubercularia Berk., 2
Trentepohlia, 101
Tricholoma Fr., 8
Trifolium minus, 270
pratense, 239
procumbens, 270
Tubercinia Trientalis Berk. & Br., 347
Tubifera ferruginosa Gmel., 21
Tulasnella Schröt., 347

Ulex, 302
Ulmus, 302, 303
Umbilicaria Hoffm., 100
Uredinales, British, including one new to the British Isles, notes on, by W. B. Grove and C. G. C. Chesters, 265
Urocystis Violae (Sow.) Fisch. de Waldh., 347
Uromyces Lk., 268, 269
Acetosae Schröt., 269, 275
Jaapianus Kleb., 270
lineolatus Desm., 267
maritimae Plowr., 267
Scirpi Burr, 267, 268, 275
sparsus Lév., 265, 266, 267, 275
striatus Schröt., 270
Uropyxis mirabilissima Magn., 1
Usnea Dill., 96, 107
florida Web., 110
longissima Ach., 107
Ustilago Boutelouae Kell. & Sw., 259, 261, 262
Boutelouae-humilis Bref., 261, 262
calcara Griff., 261, 262
*Earlei (Griff.) Cif., nov. comb., 263
filifera Nort., 258, 259, 260
Hieronymi Schröt., 257, 258, 259, 260, 262
Hieronymi Schröt., var. insularis Cif., 257, 261, 262
*Hieronymi Schröt., var. minor (Nort.) Cif., nov. comb., 262
Kolaczekii Kühn, 263
macrospora Desm., 263
minor Nort., 258, 260, 261
pamparum Speg., 262, 263
setariae Speg., 262
Ustulina Tul., 320, 321, 322, 323, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343
brachyspora Speg., 334, 341
brachyspora Speg., host plants of, 345
brasiliensis Speg., 327, 328, 329, 331
deusta (Hoffm.) Petr., 331, 333, 335, 340
linearis Rehm, 328, 329, 337
macrosperma (Mont.) Sacc., 327, 331

Ustulina maxima (Web.) Schröt., 327, 328, 330, 331, 337, 340
maxima (Web.) Wettst., 329
microsperma Trav., 331
microsperma Trav., host plants of, 345
microspora Speg., 328, 329
microspora Trav., 330, 331, 334, 338
Mori K. Haru, 334, 338
Mori, host plants of, 345
pavimentosa (Ces.) Cke., 327
placentiformis Rehm, 332, 338
placentiformis Rehm var. magnifica Rehm, 332
pyrenocrata Theiss., 331
tessulata (Berk.) Cke., 327, 329
tuberiformis (Wallr.) Cke., 327
tubulina (A. & S.) Schröt., 330
tubulina (A. & S.) Schröt., host plants of, 345
vulgaris Tul., 320, 321, 326, 328, 329, 330, 331, 332, 334, 335, 336, 337, 338, 339, 340, 342
vulgaris, host plants of, 343
zonata (Lév.) Sacc., 321, 327, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343
zonata, host plants of, 343
Ustulina, Studies in the genus, with special reference to parasitism. I. Introduction, survey of previous literature and host index, by W. H. Wilkins, 320

Vaccinium Myrtillus, 1, 2
Verbena, 86
Veronica amethystina, 76, 77
Verrucaria Pers., 108
horizontalis Zsch., 98
Vicia sativa, 277, 294, 300
Viola canina, 348
Vitis Coignetiae, 9

Wakefield, E. M., "The Ludlow foray, May 27th–31st, 1932," 1
Wakefield, E. M., "The Haslemere foray, September 19th–24th, 1932," 7
Wheat-stem rust, two new records of physiologic forms of, in Kenya Colony, by J. McDonald, 218
Wilkins, W. H., "Studies in the genus *Ustulina*—with special reference to parasitism. I. Introduction, survey of previous literature and host index," 320
Wiltshire, S. P., "The foundation species of *Alternaria* and *Macrosporium*," 135

Xanthoria Th. Fr., 100
lychnea Th. Fr., 110
parietina Th. Fr., 97
Xenodochus carbonarius Schlecht., 265
Xylaria Hill, 342
Hypoxylon (L.) Grev., 55, 81, 82
polymorpha (Pers.) Grev., 342

Zea Mays, 147
Zythia Rabiei Passer., 277

PRINTED BY WALTER LEWIS, M.A., AT THE UNIVERSITY PRESS, CAMBRIDGE